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Lord & Taylor

Fifth Avenue
38th. Street 39th. Street
New York

December 22, 1921.

Mr. A. L. Browne,
Illinois Engineering Co.,
149 Broadway,
New York City.

Dear Sir:

We are in receipt of your inquiry in reference to the operation of your vacuum traps which have been in this building since it was built, seven years ago.

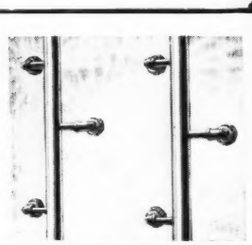
We are very well pleased indeed with the action of your traps, and also their durability. To date we have as yet not replaced any diaphrams. Inasmuch as we make it a practice of cleaning and inspecting the valves every season, we are in a position to know whether the diaphrams are in working condition or otherwise.

There are about 980 of your traps installed in this job. We find that your traps have not become leaky as we at the present time use no more jet water than we did in the beginning. Ordinarily, we do not use jet water at all except in extreme weather conditions. We also find that the vertical seat construction of your valve tends to keep the valves clean to a decided extent.

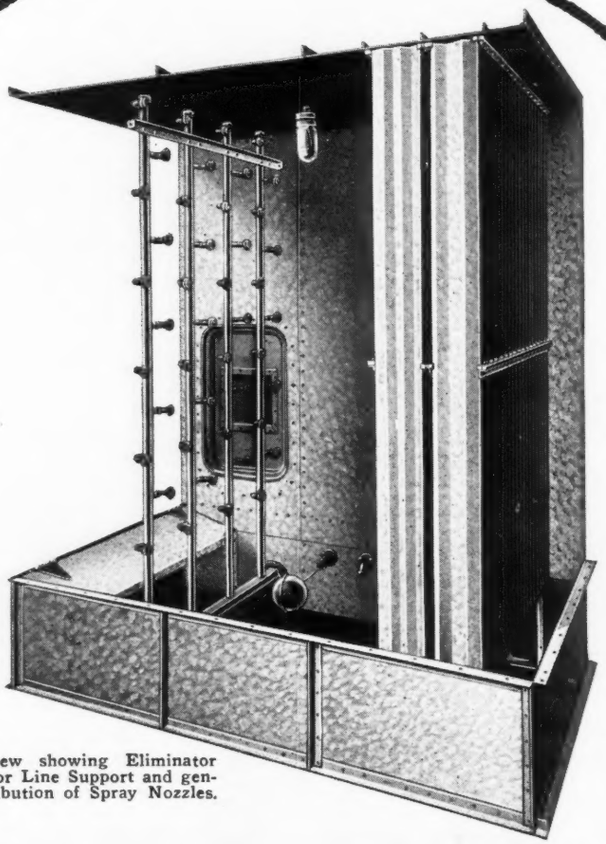
In short, we are very well satisfied with your valves and do not hesitate to recommend them as we have already done on numerous occasions as very satisfactory and very durable, and those statements are made by the writer with a full knowledge of the operation of other products than yours, which we have used in the past.

Very truly yours,

R. E. Edwards,
Chief Engineer.



Spray Nozzles which create an unbroken mist screen.



Interior view showing Eliminator Plates, Floor Line Support and generous distribution of Spray Nozzles.

Assembled view of Type "V" Washer

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Scientifically designed, thoroughly tested against the widest range of conditions, and only marketed after a number of eminent engineers had placed their stamp of approval upon it, the Clarage Type V Washer embodies improvements which you have longed for, yet never before realized, in air washing equipment.

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If you are planning any type of building which will require heating and ventilation, you will find the cooperation of Clarage engineers valuable. There is a Clarage man in your vicinity who will gladly go over the project with you

Write for this free service.

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Adapting the Oil Burner to Existing Heating Plants

Some Plain Words on Common Installation and Operating Faults, with Suggestions for Overcoming these Difficulties

By Homer R. Linn, M. E.,
American Radiator Company

(*From a paper read before the American Association of Oil Burner Manufacturers, in St. Louis, April* 3, 1924)

IT MIGHT be well, since the boiler plays an important part in the success of the installation, to start this discussion by outlining our ideas of an ideal oil-burning boiler. We have done some experimenting along this line and have decided that an oil-burning boiler should have, among other things, the following characteristics:

1. It should be of such design that any commercial oil burner could be readily installed, giving the whole installation a workmanship-like appearance.
2. It should be so designed as to give practically the same efficiency to any burner so installed.
3. It should have the highest efficiency possible, with the least chimney draft requirements.
4. It should be one in which other fuels could be burned, even though at a lower efficiency, in case of emergency.

As regards the first requirement, I am reminded, almost every time I see an oil-burner installation, that it really looks as if the oil burner had been a secondary consideration. It is usually plastered up with asbestos cement, or some other compound to make the joints between the burner and the boiler tight or, as in some cases, there may be a hole drilled through the fire door to allow the insertion of the oil burner nozzle, all of which looks very unworkmanlike and really detracts from the appearance of the complete installation.

Second: I am sure you have all found that burners work better in certain types of boilers than they do in others. Therefore, your troubles are very often not due to the burner, but are due to the fact that the salesmen have been a little too enthusiastic in selling the burner and have allowed it to be installed in a boiler not adapted to its use.

Third: A boiler which would require excessive chimney draft to get proper combustion in the oil burner would be suitable to only a few types of oil burners, and, in fact, would not always give successful operation even then.

Fourth: It seems to me that an oil burner will meet with a more ready sale if the boiler could be readily adapted to hard fuel, in case of a shortage of oil, gas, or electricity, although it need not burn this other type of fuel so efficiently, nor so easily as oil, inasmuch as it would only be required to burn it for short intervals.

An oil-burning boiler should have the gas-ways so proportioned, as to cross sectional area and length, to give the greatest possible efficiency practicable. It is not advisable to decrease the area or increase the length of the flue-ways beyond well-defined limits. The combustion space should be large enough to allow complete combustion before the gases come in contact with the cooler walls of the boiler.

EXPERIENCES WITH OIL BURNERS IN ROUND BOILERS

I would like to discuss some of the more common installations in existing heating plants, which have come under my observation. Take, for instance, the round boiler. I have found oil burners installed in round boilers of all sizes and heights, including three, four, five and six-section boilers. The three and four-section boilers for oil burning are almost invariably unsuccessful installations. The five-section round boilers for oil are sometimes successful, especially where the boiler capacity is considerably greater than the radiation load.

In other words, say, for instance, an installation consisting of 500 sq. ft. of direct column radiation, standing in 70° F. air, which is heated by a five-section round boiler of 1,200 sq. ft. capacity, would very probably have a somewhat successful installation, but with this same amount of radiation, if you

had a 750 sq. ft. capacity five-section boiler, you would, in all probability, find the owner of this installation complaining of an excessive amount of oil used. With the six-section round boiler properly proportioned to the load, you may expect to find a fairly successful oil-burner installation.

Another characteristic of these boilers is that should they be compelled to burn coal at intervals, the three and four-section round boilers would burn bituminous coal much more efficiently than the five or six-section round boilers, while the latter would burn anthracite coal more efficiently than they would bituminous coal.

I saw one installation recently of a five-section round boiler from which the smoke connection had been removed from top of the boiler, the boiler then completely enclosed in a brick setting, which had a gas-way of approximately 3½ in. around the boiler, so that the gases coming up through the boiler sections were diverted downward and left this brick setting at the bottom. In doing this, the installation engineer had not taken into consideration the draft, and as this turned out to be a leaky chimney, and, therefore, poor draft, it was one of the worst-sooted jobs I have ever seen.

DOWN-DRAFT BOILERS BURN OIL SUCCESSFULLY

We are often asked as to the effect of a down-draft boiler when used in connection with an oil burner. I have found them to be uniformly successful as oil-burning boilers, especially when the lower grates are removed and a false bridge-wall so built as to deflect the gases up through the front of the water-grate and down through the back of the water-grate.

HIGH CHIMNEY TEMPERATURES WITH HORIZONTAL SECTIONAL BOILERS

The installation in horizontal sectional boilers has really been more successful from an oil-burner standpoint, than the round boilers. This is due to the fact that most sectional boilers are so inefficient when oil burners are installed in them, that the oil-burner installation man is careful to see that part of the up-take flues are stopped off so as to give the gases more travel. However, most sectional boilers are designed for bituminous coal, and since these products of combustion require quite large flue-ways, unless this boiler is a smokeless type, you will find the chimney temperature rather high, which means inefficiency.

The really hard boiler in which to install an oil burner efficiently is the horizontal tubular type, because there is no means of baffling the course of the gases.

RATING OF COAL-BURNING BOILERS FOR OIL BURNING

The question of proper rating of coal-burning boilers, for oil burning, has been a much abused subject, and for this I blame the boiler manufacturer more than I do the oil-burner manufacturer. In order to thoroughly understand the proper rating of a boiler when burning oil, it would be necessary for the boiler manufacturer to test his boilers, when equipped, with several different types of oil burners. It is evident that we might expect a different capacity from the same boiler, using different oil burners, the same as we get a different capacity of a coal-burning boiler when soft coal is fired, than what we do when hard coal is fired.

In any case, the rating of a boiler should be expressed in terms of B.T.U. delivered at the nozzle of the boiler, or in some expression based on this output.

LOW-PRESSURE HEATING BOILER TESTING AND RATING CODE OF THE A. S. H. & V. E.

It might clarify matters some if we would consider the standard method of rating coal-burning boilers. Most coal-burning boilers are today tested and rated in accordance with the code for testing and rating low-pressures heating boilers, established by the American Society of Heating and Ventilating Engineers, and given in their Transactions of the year 1919. According to this society's established method, the rating of a coal fired heating boiler is based on the pounds of coal burned from one fuel charge, when enough live fuel is left in the boiler for properly rekindling the new fuel charge, multiplied by the pounds of water evaporated by one pound of coal so burned. This gives the number of pounds of steam produced at the nozzle of the boiler. This result, when multiplied by four, which is the number of square feet of radiating surface required to condense one pound of steam per hour under standard conditions, and divided by the number of hours in which this charge of coal was so burned without attention, gives the boiler's continuous rating for this amount of coal fired. Since it is difficult to find bituminous coal of uniform burning quality, most boilers are rated on anthracite coal, and then a factor used to transfer this heat power to soft coal.

In computing boiler ratings, it should be noted that standard conditions are taken as the basis. This is necessary because of the many varying factors controlling a boiler's performance. These standard conditions are:—

1. Steam boilers—steam pressure, 2 lbs. gauge at boiler outlet.
2. Water boilers—water 180° F., at boiler outlet.
3. Fuel—Anthracite coal of 13,000 B.T.U. per pound.
4. Boiler equipped with chimmey of proper size height.
5. Fire surfaces clean and boiler capacity not diminished in efficiency by the accumulation of soot.

HOW OIL-BURNING BOILERS SHOULD BE RATED

Oil-burning boilers should be rated on the basis of the pounds of oil burned per hour in the burner installed, times the pounds of water evaporated per pound of fuel so burned. This amount, multiplied

by four, would give us the rating of the boiler for any particular burner.

Some burner manufacturers do not recommend their burners for continuous operation. In that case, it should be necessary to know what percentage of time the burner would be calculated to run in an hour.

Inasmuch as the oil-distributing companies are just at present somewhat undecided as to the kind and gravity of oil which they will be able to furnish for domestic heating in the next two or three years, it would be rather hard to rate boilers on a flat rating for any burner.

COMMON DIFFICULTIES IN OIL-BURNER INSTALLATIONS

May we now consider some of the difficulties encountered in oil-burner installations: One of the most common complaints that comes to our office is that of poor draft due to bad chimneys. We have found this to be particularly true of those burners that rely to some extent on natural draft to furnish the necessary air for combustion.

We have in mind one installation of a blower type of burner which was installed in a water heating system. We found, on inspection of this job, that the only test they had ever put on the chimney was to burn some paper in the smoke pipe leading to the flue, and because the flue took this paper in readily they assumed they had a good draft. However, when we put a smoke test on the chimney, we found that it leaked in several places, which when it was repaired by tearing down the chimney and building a new one, everything worked successfully.

Another very common complaint coming from steam or vapor installations is the inability to raise steam pressure, or if they can raise steam pressure, to keep the water in the boiler. This is invariably caused by dirty water, due, ordinarily, to grease from the piping system. It might be well to call attention to the fact that practically all of the pipe manufactured today is quenched in a form of mineral oil, which, after the heating system is in operation, comes down into the boiler and causes it to prime.

Our remedy for this trouble is to boil it out over the top. To do this we take off the pop valve and insert a short nipple, then a tee and in the other run of this tee put back the pop valve. In the side outlet of the tee put a short nipple, then a gate valve, and run a pipe to the sewer or out of the window. Let enough water into the boiler so as to bring the water level up to the top trycock, then fire the boiler so as to get up 4 or 5 lbs. steam pressure and open the gate valve just wide enough so that the pressure does not drop materially when you let in more water to make up for what is blown out. At first it may not be possible to have the gate valve very wide open, but as the boiler is cleaned of the dirty water, you will be able to open the gate valve wider. This boiling process should be kept up until the water is clean. It usually takes from four to ten hours to do this, and in most cases has to be repeated several times at varying intervals.

PROPOSED INSTALLATIONS SHOULD BE CHECKED BY COMPETENT ENGINEERS

Another complaint that comes in to our office quite often is the fact that a man has installed an oil burner but is still unable to heat the northwest bedroom, the sun parlor, etc., which did not heat when he was burning coal. The oil burner salesman had told him their burner solved all troubles; then, of course, when it did not he decided it was the boiler's fault. I would like to caution oil-burner manufacturers that I believe they will save themselves a great deal of trouble and will really further the sale of their burners if, until oil burner installations are better understood, they will insist upon having all of their sales passed on by a competent engineer in their own employ who will have authority to reject or accept the installations passed to him for decision. He will be able to ferret out those jobs which will surely in the end give them trouble for which they were not to blame. If he is held responsible for trouble jobs, he will certainly eliminate the installation of oil burners in inefficient boilers, heating systems that have wrong piping, or systems that are poorly designed.

Another complaint we hear a great deal about is automatic regulation. One manufacturer told us recently that 90% of all his trouble calls were on account of the regulation. Another told us that 80% of his trouble calls were from the same cause, while another told us that since adopting a certain system of automatic regulation he had reduced his trouble calls 75%.

SIX RULES FOR SUCCESSFUL INSTALLATIONS

In summing up the things pertinent in the installation of an oil burner in an existing heating plant, may we call your attention to the following:

1. Be sure that the present boiler is adapted to oil burning.
2. Be sure that there is a sufficient amount of radiation installed in each room to properly maintain the desired temperature.
3. Be sure that the piping system is properly designed to carry the necessary amount of heat to each radiator.
4. Be sure that there is no chimney trouble.
5. Be sure that the boiler water, in case of steam or vapor systems, is clean.
6. Be sure that the owner understands that he may have to pay more for oil within the next two or three years than at present.

Death of William J. Baldwin

As we go to press, word reaches us of the death of William J. Baldwin, the acknowledged dean of the heating and ventilating profession in America. Mr. Baldwin died suddenly May 7, in a Brooklyn business street.

Through a singular coincidence, an extended sketch of Mr. Baldwin's career appeared in THE HEATING AND VENTILATING MAGAZINE for April, less than a month before his death.

A gentleman of the old school, Mr. Baldwin maintained his brave and kindly spirit to the last. Hail and farewell!

Practical Notes On The Cooling Of Air

Data Covering a Typical Mechanical Refrigeration Installation in a Chocolate-Dipping Factory

By H. J. Macintire

Associate Professor of Refrigeration, University of Illinois.

ONE of the most important industrial applications of mechanical refrigeration at the present time is that of the cooling of air. This problem may be that of blowing a cool air in dough in a bakery, in a gelatine capsule manufacturing plant, in photographic films plant or in an auditorium where in every case a temperature is desired, lower than that of the atmosphere, but yet conditioned to the correct amount and to the proper extent to satisfy the conditions of the plant.

In most cases the problem involves that of absorbing the heat generated by all factors,—machinery, lights, processes and materials to be cooled,—the condensation of the water vapor evolved by the process or thrown off by persons or commodities present, the removal of heat leakage and by the cooling and the conditioning of the air from the outside which is brought into the room for ventilating purposes or by infiltration.

In every case where refrigeration is used, the temperature is not the only consideration, but the humidity is likewise an important factor. In some cases it is a matter of preventing moisture from precipitating on the surfaces of the manufactured article, or the commodity which has gone through a chilling stage of the process. In other cases, as in the case of theatre cooling, the consideration is the comfort of the people in the auditorium. But in any case it is necessary that a certain dew-point temperature be arrived at, so that the air leaving the spray chamber will be reduced to the proper amount of moisture per pound of dry air.

For example, suppose that a chocolate-dipping plant requires (in order to secure the best lustre on the individual chocolate drops) a dry-bulb temperature of 65° F., and a relative humidity of 60%. This corresponds to a dew-point temperature of 50.7° F., and a wet-bulb temperature of 56.7°, and 55 grains of water vapor per pound of dry air.

FIGURING A CHOCOLATE FACTORY PROBLEM

As an example of the calculation of such a problem, a successful installation will be given, as follows:

A chocolate-dipping room (Fig. 1) has a cubical contents of 204,300 cu. ft., 1284 sq. ft., of glass and 908 sq. ft., wall surface exposed to the sun's rays and 2152 sq. ft. of glass, 1863 sq. ft. wall, 2728 sq. ft. of partition and 12,770 sq. ft. of floor area not exposed. The temperature of the outside air is 95° F., and the wet-bulb temperature is taken as 76° F., while the infiltration is assumed to be one complete volume of the room in five hours. Five hundred operators in the room will require 39 250-watt lights. Water will be used in the spray chamber

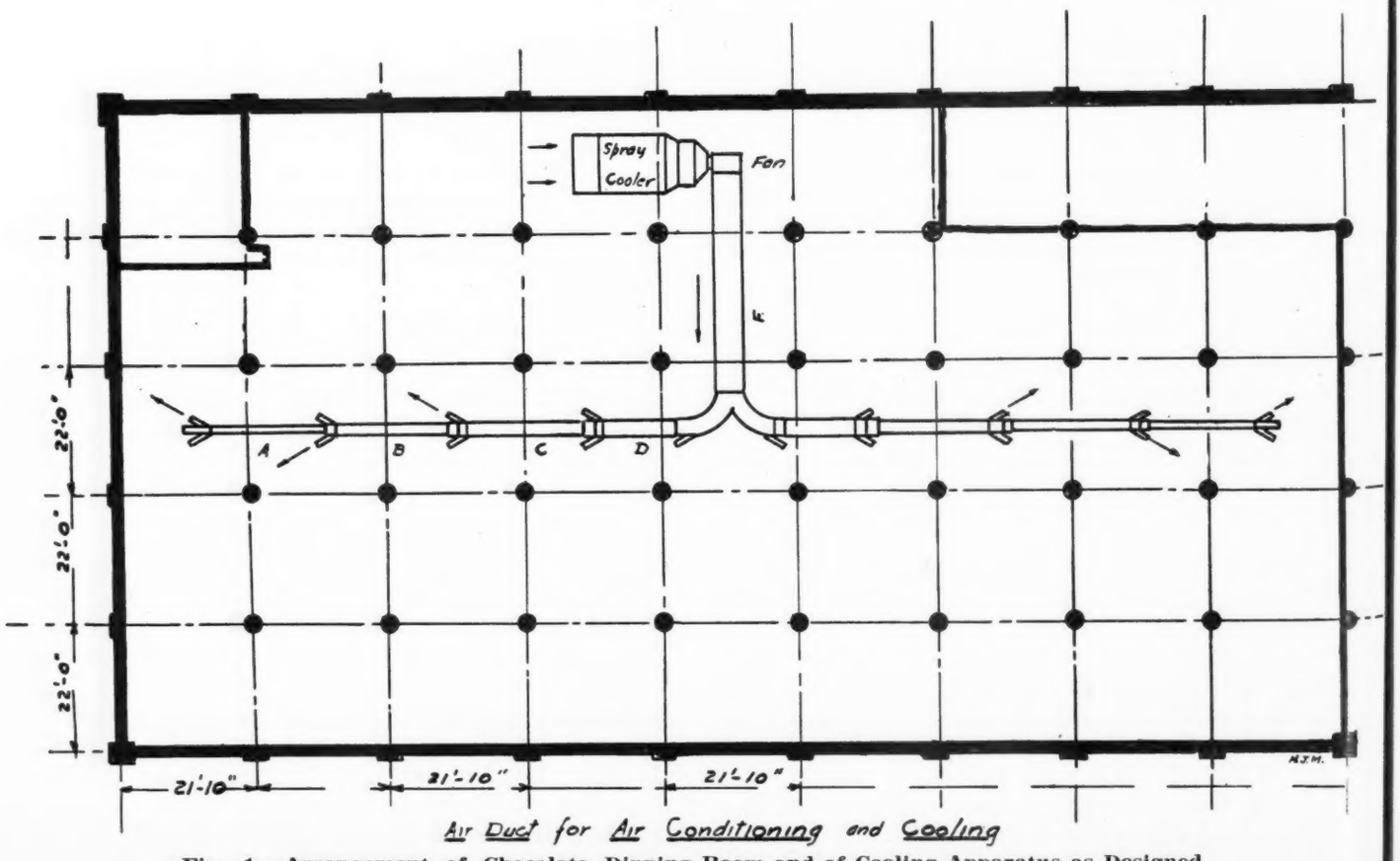


Fig. 1—Arrangement of Chocolate Dipping Room and of Cooling Apparatus as Designed

which will rise from 43° to 51° F. 90% of the air will be recirculated.

The calculation is as follows:

	B.T.U. per minute.
Effect of the sun's rays	715
Sensible heat of 500 operators	2500
Conduction (glass, wall, partition, and floor)	1200
Infiltration	366
Illumination	556
Total sensible heat	5337
Add 5% for safety	267
TOTAL	5604
Heat equivalent of mechanical work of the fan (estimated)	272
	5876

This 5876 B.T.U. per minute is not the total heat to be removed by the refrigerating machine. This is only the "sensible heat" tending towards a rise of temperature of the air. The air entering the spray chamber is cooled from 65° to 50.7° F., or an amount of 14.3°. The air required to be circulated to absorb this heat is

$$\frac{5876}{14.3 \times 0.241} = 1704 \text{ lbs.}$$

and each pound will occupy 13.05 cu. ft. or 22,240 cu. ft. of air per minute required of the fan.

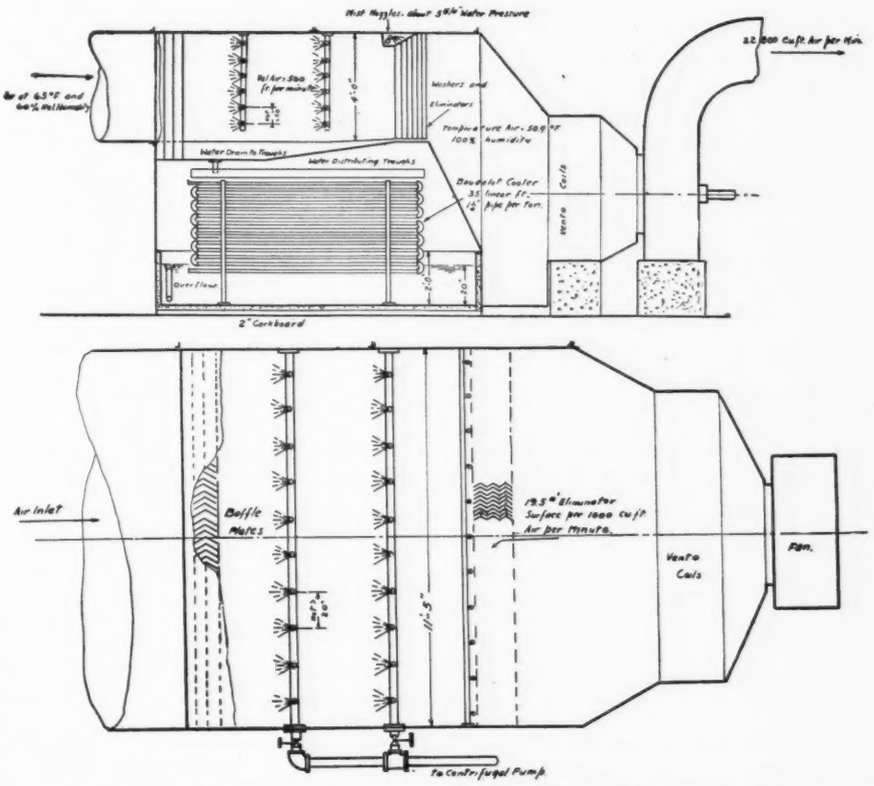

Mist Nozzles, about 5# Water Pressure
22,300 Cu.ft. Air per Min.
Air at 65°F. and 60% Relative Humidity
Washers and Eliminators
Temperature Air - 50.9°F. 100% Humidity
Water Drain to Trough
Water Distributing Troughs
Baudelot Cooler 35 linear Ft. 1/2" Pipe per Ton.
Vento Coils
Over Flow
2" Corkboard
Air Inlet
Baffle Plates
19.5 sq.ft. Eliminator Surface per 1000 Cu.ft. Air per Minute.
Vento Coils
Fan.
To Centrifugal Pump

Fig. 2—Form of Spray Chamber Used, with Baudalot Cooling Coil Directly Underneath

Refrigeration. The recirculated air is cooled from a wet-bulb temperature of 56.7° to 50.7°, and the heat removed is 3.45 B. T. U. per pound of dry air.

3.45 x 1704 x 0.90 = 5290 B. T. U. per minute.

TABLE I—CAPACITY TABLE OF BRINE SPRAY NOZZLES

(Note: Use 5 lbs. to 20 lbs. pressure on Nozzles, as a Rule).

Dia of Pipe Conn	Dia Cap Opening	Capacity - lbs per Minute — Pressure on Nozzle - lbs per Sq in										
		10	20	25	30	40	50	60	70	80	90	100
1/4"	1/32"	0.27	0.39	0.44	0.48	0.55	0.62	0.68	0.73	0.79	0.83	0.89
1/4"	1/16"	1.0	1.5	1.7	1.8	2.1	2.4	2.6	2.8	2.9	3.2	3.4
1/4"	3/32"	2.3	3.3	3.7	4	4.6	5.2	5.7	6.1	6.5	6.9	7.3
3/8"	1/8"	4.6	6.5	7.3	8.0	9.2	10.0	11.0	12	13	14	15
3/8"	3/16"	10	15	17	18	21	23	26	28	29	31	33
1/2"	1/4"	18	26	29	32	37	41	45	49	52	56	58
3/4"	3/8"	51	72	81	88	102	114	125	135	144	153	162
1"	1/2"	91	128	144	157	181	202	222	240	257	272	
1 1/4"	5/8"	127	182	204	226	267	287	310				
1 1/2"	3/4"	186	263	295	332	370	415					
2"	7/8"	252	356	400	435	501						
2"	1"	330	465	522	570	657						
2 1/2"	1 1/4"	515	728	815	890							

The *outside air* is cooled from 76° F. wet-bulb to 50.7°, or it has 17.95 B. T. U. removed per pound.

17.95 x 1704 x 0.10 3060 B. T. U. per minute.

The moisture in the air of infiltration is 104—55=49 grains per pound and there are 47.6 lbs. of air per minute entering the room, therefore

0.333 lbs. of moisture or 0.333 x 1060 =350 B. T. U. per minute must be removed.

The moisture produced by the operators at 3.0 B. T. U. per minute per person will be 500 x 3.0 = 1500 B. T. U.

The heat equivalent of the power necessary to circulate the water at 5.0 H. P. is 212 B. T. U. per minute.

Finally radiation and other losses of apparatus 50 B. T. U.

Total	10462 B. T. U. per minute
Add 5%	523
	10985 B. T. U. per minute
	54.93 tons of refrigeration

As the air is to be cooled by means of water sprays in a spray chamber, the water to be allowed to rise 8°F., the total amount of water required per minute will be

$$\frac{10.985}{8.33 \times 8} = 165 \text{ gal.,}$$

but it will be safer to design the spray chamber for 200 gal.

The form of spray chamber used will be one with a Baudalot water cooler directly underneath, as shown in Fig. 2. With reasonable care the danger of ammonia coming into the air of the room is very small. The kind of nozzle and the pressure on the nozzle determines the amount of water which will pass through. Usually the

pressure is about 20 lbs. and the amount of water is 15 lbs. per minute. For 200 gal. per minute, there will be required

200 x 8.33/15 = 111 nozzles.

The nozzles should be spaced not greater than 20 in. apart and not less than 6 in. apart and the air velocity through the spray chamber must be approximately 500 ft. per minute. Taking a spray chamber height of 4 ft., the width becomes 11 ft. 5 in. and two rows of 10 stands spaced 13 in. on centers and 6 nozzles high on 7 in. centers will give 120 nozzles, and these can operate on slightly less than 20 lbs. per sq. in.

The eliminators are placed in the spray chamber to catch the entrained moisture. As a rule about 20 sq. ft. of surface (figured for one side only) is used per 1000 cu. ft. of air passed per minute. Some times the eliminator surface has mist nozzles for flooding it. Fig. 2 shows such an arrangement.

The Baudalot cooler in Fig. 2 is arranged to take the water from the sprays by gravity, the water passing on the outside from pipe to pipe. Under such circumstances it is customary to use 35 lin. ft. of 1¼ in. pipe per ton of refrigeration, so that 35 x 55 = 1925 lin. ft. of pipe will be needed. Using pipe only 8 ft. long and 14 pipes

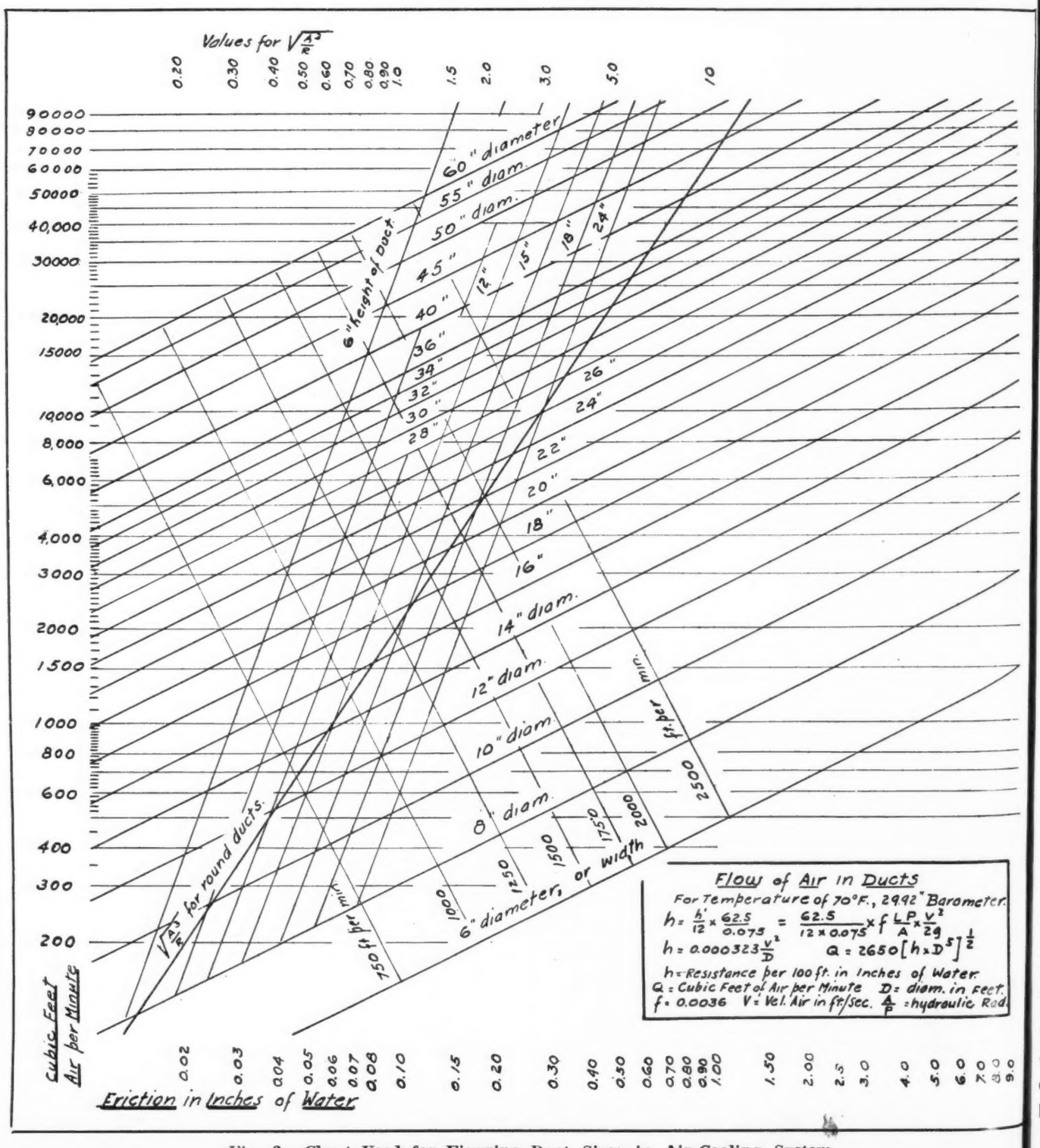

Values for $\sqrt{\frac{A^5}{P^2}}$
0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.0 1.5 2.0 3.0 5.0 10
90000 80000 70000 60000 50000 40,000 30000 20,000 15000 10,000 8,000 6,000 4,000 3000 2000 1500 1000 800 600 400 300 200
60" diameter
55" diam.
50" diam.
45"
40"
36"
34"
32"
30"
28"
26"
24"
22"
20"
18"
16"
14" diam.
12" diam.
10" diam.
8" diam.
6" diameter, or width
6" Height of Duct
12" 15" 18" 24"
$\sqrt{\frac{A^5}{P^2}}$ for round ducts.
150 ft per min.
1000 1250 1500 1750 2000 2500 ft. per min.
Cubic Feet Air per Minute
0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.10 0.15 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.50 2.00 2.5 3.0 4.0 5.0 6.0 7.0 8.0 9.0
Friction in Inches of Water
Flow of Air in Ducts
For Temperature of 70°F., 29.92" Barometer.
$h = \frac{h'}{12} \times \frac{62.5}{0.075} = \frac{62.5}{12 \times 0.075} \times f \frac{L}{A} \frac{P}{2g} \times V^2$
$h = 0.000323 \frac{V^2}{D}$ $Q = 2650 [h \times D^5]^{\frac{1}{2}}$
h = Resistance per 100 ft. in Inches of Water.
Q = Cubic Feet of Air per Minute D = diam. in Feet.
f = 0.0036 V = Vel. Air in ft/sec. $\frac{A}{P}$ = hydraulic Rad.

Fig. 3—Chart Used for Figuring Duct Sizes in Air-Cooling System

TABLE II. TYPICAL FAN CHARACTERISTICS FOR SELECTING THE FAN SIZE

Size	Dia. of Blast Wheel	Area of Outlet Sq. Ft.	½" Static Pres.			¾" Static Pres.			1" Static Pres.			1½" Static Pres.		
			R.p.m.	Cu. ft per Min.	H.P.	R.p.m.	Cu. ft. per Min.	H.P.	R.p.m.	Cu. ft per Min.	H.P.	R.p.m.	Cu. ft. per Min.	H.P.
6	31⅜	5.25	272	7780	1.11	334	9525	2.03	386	11000	3.12	472	13450	5.80
7	36½	7.14	233	10590	1.52	286	12950	2.77	330	14980	4.24	405	18330	7.90
8	42	9.33	204	13820	1.98	250	16910	3.61	289	19550	5.54	354	23950	10.3
9	47	11.81	181	17500	2.51	222	21400	4.57	256	24750	7.01	314	30300	13.05
10	52	14.58	103	21600	3.09	200	26450	5.65	231	30550	8.65	283	37400	16.10
11	58	17.64	148	26150	3.74	182	32000	6.85	210	37000	10.48	257	45250	19.48

high, there will be required 17 + stands which can be arranged for on 6 or 7-in. centers.

Fig. 1 shows the arrangement of ducts which can be used, and in the calculation of the duct sizes the chart shown in Fig. 3, can be used to advantage. Taking a uniform pressure drop of 0.14 in. per 100 ft. of length, the following table is obtained.

Section.	Quantity air Cu. ft. per min.	Diam. duct in inches	Velocity in ft. per min.	Length Section and allowance for ells etc.
a	2500	17	1600	22′+0.22×0.09
b	5000	24	1600	22
c	7500	27	1900	22′
d	11120	31	1900	22′+ .15× .24
e	22240	42	2350	44′

The total resistance of the duct is 132/100×0.14+0.02 +0.036 = 0.241 and allowing 50% for roughness of the duct surfaces this becomes 0.241 × 1.50 = 0.362.

The total pressure required of the fan therefore will be

Static pressure	0.362
Spray chamber loss	0.250
Velocity pressure (1180 ft.)	0.090
	0.602 in. water column.

and allowing for temperature (51°) this becomes 0.615 in. of water. A fan should be selected for 22,200 cu. ft. per minute and a total pressure of 0.615 in.

In some installations the recirculated air will be much less than is used in the problem. Also other factors will vary, but the method is substantially as given in the calculation. The Baudalot cooler would require a boiling temperature of the ammonia of (say) 31°F. which corresponds to a pressure of 46 lbs. gage very nearly. Such a boiling temperature with 150 lbs. condenser pressure would require 0.7 H. P. per ton of refrigeration or a little more than 30 H. P. (neglecting friction losses) and the ammonia compressor will require 2.2 cu. ft. per ton or 121 cu. ft. per minute piston displacement of the compressor.

A Scheme For Heating Buildings With Refrigerating Plants

A scheme for heating homes through the use of refrigerating machines, has been proposed by Robertson Matthews, of the Department of Power Engineering. Cornell University and is the subject of a paper by Raymond F. Yates. In presenting the scheme the question is asked at the outset, "Why is it necessary for us to heat gases to a temperature of 2000° F. in our heating furnaces when there is but a relatively small difference in the outside and inside temperature?"

Following up this thought, the writer assumed an outside temperature at the freezing point and points out that the difference between this temperature and 70°, which is normal room temperature, is but 38°. "Why in the name of reason," he continues, "is it necessary for

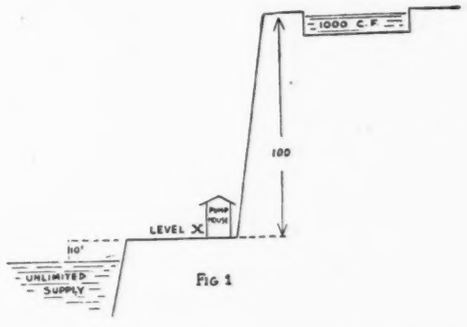


Fig 1

Fig. 1. Illustration of Problem in Hydraulics

us to use furnaces that heat the atmosphere to a temperature of several hundred degrees to make up this small difference? It is apparent that a terrible waste of energy takes places in the heating systems that we use to-day."

PRINCIPLE ILLUSTRATED BY PROBLEM IN HYDRAULICS

As an aid to understanding his scheme, Mr. Matthews draws attention to a problem in hydraulics which is not unlike the heat problem to which he refers. Referring to Fig. 1, we note water at two levels. In one case water in a small pond is at a height of 100 ft. There is but 1000 cu. ft. of

water here. At the lower level, there is a practically unlimited supply of the liquid, and a farmer with a garden on level X desires to water his crops, but finds there is not sufficient water for this purpose in the little pond on the high level. This is overcome by the installation of a turbine-driven pump installed at level X and operated by the water from the pond. Providing the pump and turbine operate at high efficiency, the pump will deliver from the lower level 10,000 cu. ft. of water to the level X, an amount which is sufficient for the farmer's needs.

In a way, it is pointed out, this is similar to the problems under consideration. Mr. Matthews suggests taking a high head of heat or a small amount of heat at high pressure to release and use a large amount of heat at lower pressure, the lower pressure being represented by the vast quantity of low-pressure heat in the atmosphere.

The layman might ask the question, "How can we pump heat?" This can be done by a refrigerating machine which is nothing more or less than a heat pump. In the problem under consideration, a heat pump or compressor that would build up a higher pressure than those ordinarily employed would have to be used.

ARRANGEMENT OF PROPOSED SYSTEM

Referring to Fig. 2, a layout is shown for a building to be heated by the proposed system. At point B there is placed a duct which allows cold air from the outside to enter, where it immediately comes in contact with the gas-heated coils A. Here the

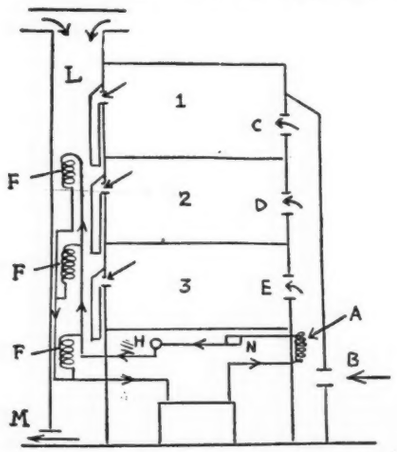


Fig. 2. Proposed Layout of Refrigerating-Heating System

cold air is heated to room temperature and allowed to pass through ducts C, D and E into rooms 1, 2 and 3. Here part of the heat that the air carries is absorbed (flows downhill) by the air already in the rooms. The exhaust air then passes out through the three ducts at the ends of the rooms into the shaft L. Here it comes into contact with some very cold pipes from the ammonia compressor used in connection with the refrigeratng system.

Since the temperature of the gas that was exhausted from the rooms is higher than that of the ammonia in the cold pipes, energy in the form of heat is absorbed by the ammonia in the pipe and the temperature of the exhaust gas is made lower. This gas is then exhausted from the duct M into the outer atmosphere.

Liquid ammonia is discharged from the receiver N through the expansion valve H and this causes it to suffer a drop in temperature. In the coils F the cold gas gathers in heat from the exhaust room gases. It will be seen that on one side of the expansion valve or in the coil of pipes A, the liquid gas, after having been heated by compression in the compressor (a highly compressed gas is always heated during the process of compression), gives up part of this heat to the incoming air only to take part of this heat back again in the other shaft, for after the gas passes through the expansion valve, its temperature takes a very sudden drop and when it reaches the coils in the other shaft, its temperature is very low and consequently it is able to absorb heat from the comparatively warm gases coming from the heated rooms. It will be understood that this temperature of the exhaust gases would ordinarily be lost.

NOT A PERPETUAL-MOTION IDEA

"The reader should not think that this system borders on perpetual motion," concludes Mr. Yates. "Energy is required to operate it and anything that requires energy to operate it cannot be classed with so-called perpetual motion devices. It is simply a highly efficient heat-generating and dispensing device based upon principles that are very well understood. Indeed, the rough suggestion was made over sixty years ago by no less a person than Lord Kelvin. Even at that time Kelvin deplored the wasteful methods of producing heat from the well-known fuels. He would see few improvements if he were alive to-day. We still waste millions of horsepower yearly in our crude efforts to nurse from coal (and other fuels like crude oil) all of the energy that it has to give."

Safe Practices in Acetylene and Oxygen Welding

Some suggestions for the heating and ventilating engineers and contractors are contained in an article by H. S. Smith, appearing in *Safety Engineering* for April, 1924, and dealing with safe practices in connection with acetylene and oxygen welding. For instance, speaking of the storage of supplies of calcium carbide, compressed acetylene and compressed oxygen, the writer says:

"Calcium carbide does not constitute a fire hazard, but when brought in contact with water, acetylene is generated, and acetylene is an inflammable gas. Therefore, calcium carbide should be stored only in dry and well-ventilated places. Many users store their calcium carbide in the same building or compartment in which their acetylene generator is housed. When the calcium carbide is stored in the same compartment with the acetylene generator the carbide should be placed on a platform at least 6 in. higher than the main floor level, so as to keep the drums clear of any water that might get on the floor when the generator is being flushed or when the floor is being washed."

Aerology for Amateurs and Others

The Evolution of Modern Ventilation and its Effect on Present and Future Practice

By E. Vernon Hill

Previous articles in this series are as follows: January, 1923, Historical Sketch; February, 1923, Health and Comfort Factors; March, 1923, The Manufacture and Use of Thermometers; April, 1923, Test Methods; May, 1923, Air Dust; September, 1923, Classification of Test Methods for Dust Determinations; October, 1923, Discussion of Test Methods for Dust Determinations; November, 1923, Odors; December, 1923, CO_2; January, 1924, Air Distribution; March, 1924, Measuring Air Velocities.

XII—Measuring Air Flow

IT MAY be of interest to the reader to know how the Kopnaerimeter is calibrated as it is a difficult matter to accurately calibrate any air-testing instrument unless suitable apparatus for this work has been provided. The test equipment, which has been found entirely satisfactory, was worked out by O. W. Armspach, and is known by the somewhat cumbersome name of the Rapid Adjustment air flow meter (see Fig. 39).

THE RAPID ADJUSTMENT AIR FLOW METER

The meter complete consists of a small high-pressure Leiman blower, belt-driven by a constant-speed motor. The blower has a capacity of about 5 cu. ft. per minute against a maximum pressure of 24 in. of water. The outlet of the blower discharges into a ¾ in. metal "t" with flow regulating gate valves "c" and "d" on either side. From the distal side of the gate valve "d" the piping is increased to 1 in. in diameter where the flow meter proper is inserted to 1 in. in diameter where the flow meter proper is inserted in the line.

The flow meter consists of a horizontal 1-in. glass tube, somewhat constricted in the center. In the constricted portion various calibrated nozzles are inserted. On either side of the constriction connections are made to a 24-in. "U" tube graduated above and below the zero line in the center. The graduations are to one-tenth of an inch. From the point "f" the flow meter is connected by a piece of firm rubber tubing to a brass tube (g) approximately 1-in. in diameter and 12-in. long. The diameter of this tube has been carefully measured with micrometer calipers and the inside area accurately determined. The calibrated nozzles, previously referred to, consist of short pieces of glass tubing of various internal diameters, thrust for convenience through rubber stoppers. These orifices have been individually calibrated by means of an accurate gas meter and the relation of the flow to pressure drop across the nozzle determined.

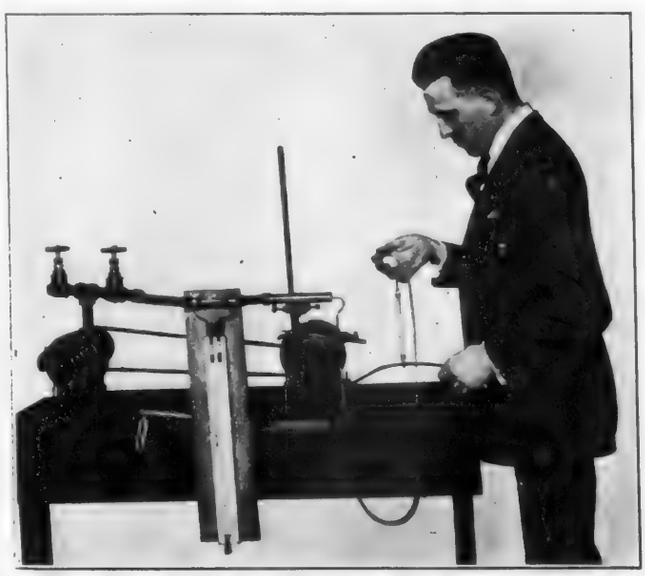


Fig. 39. Method of Testing the Kopnaerimeter

In using the "Rapid Adjustment" air flow meter the blower is started with flow-regulating valve "c" wide open and "d" closed. Valve "d" is closed to prevent the high pressure of the air from blowing the liquid out of the manometer. Next, by slowly opening valve "d", air flows through the calibrated nozzle and out the opening of the metal tube "g", the volume of air passing through the calibrated nozzle being instantly shown on the manometer by reference to the curves for each nozzle.

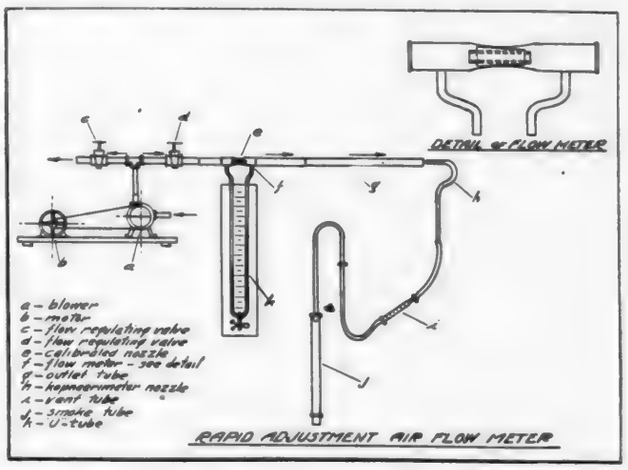

DETAIL of FLOW METER
a – blower
b – motor
c – flow regulating valve
d – flow regulating valve
e – calibrated nozzle
f – flow meter – see detail
g – outlet tube
h – kopnaerimeter nozzle
i – vent tube
j – smoke tube
k – U-tube
RAPID ADJUSTMENT AIR FLOW METER

Fig. 40. Design of Rapid Adjustment Air Flow Meter

Having previously determined the different velocities necessary to obtain accurate curves for the Kopnaerimeter, it is only necessary to refer to the table giving the required pressure drop across the nozzle to obtain the desired air velocity and to adjust the flow-regulating valves. "c" and "d" until this pressure drop shows on the gauge. This gives the required volume of air at the outlet of the apparatus. To obtain the velocity, it is only necessary to divide the volume by the calculated area of the tube.

VELOCITY HIGHEST NEAR CENTER OF TUBE

The fact could not be ignored that the velocity of discharge from a circular tube or duct is not uniform over its entire area, the velocity being the highest near the center of the tube and decreasing a varying amount as the walls of the tube are approached. Careful exploration, therefore, was made of the velocities at the outlet tube by means of a special Pitot tube. This tube was constructed from very small tubing used in the manufac-

ture of hypodermic needles, with which a very close approximation of the tube to the sides could be made. From these experiments it was determined that the velocity of the air at the center of the tube, 1/32 in. distance from the end, gave the true average velocity for the tube as a whole.

HOW TO TEST THE KOPNAERIMETER

In testing the Kopnaerimeter the nozzle is now clamped at the center of the outlet of the testing apparatus 1/32 in. from the end of the tube. The smoke tube is carefully filled with smoke and held in a vertical position away from the nozzle and in a location where it is not influenced by air currents. The smoke tube is filled slightly higher than is customary in actual use and the finger placed over the outlet. With the stop watch in readiness, the finger is removed from the outlet of the smoke tube. The smoke immediately begins to descend and, the instant the meniscus appears, the stop watch is started and the time required for the tube to clear of smoke carefully determined. This operation is repeated until a sufficient number of points are obtained to plot the curves for each opening in the vent tube, and the velocity chart plotted therefrom.

After several hundred readings had been made it was discovered that the curves were logarithmic curves, and if plotted on logarithmic paper all points for each vent opening fell on a straight line. This materially simplified the testing as it is now only necessary to determine three points for each vent opening. The values are then taken off the logarithmic curves and replotted for the chart that accompanies each instrument. Inasmuch as there are no moving parts in the apparatus there is no possibility of the instrument getting out of adjustment, and it has been repeatedly observed that the tester can go back and check any point obtained with remarkable consistency.

The rubber tube, while it must be of the same bore and length, can be coiled or held in any position without affecting the accuracy of the readings. The temperature of the air or its moisture content within ordinary limits does not affect the results.

THE QUADRANT MANOMETER

A slant gauge of the Ellison type is a convenient and accurate instrument for ordinary Pitot-tube determinations, but it is not sufficiently delicate to measure velocities much below 500 ft. per minute. Where accurate measurements are required at low velocities some other type of gauge is necessary.

The Quadrant manometer was designed by the writer some years ago for low-pressure work. With this gauge velocity pressures below 0.0006, which is equivalent to less than 100 ft. per minute, can be accurately determined. It consists of a base board (see Fig. 41) supported at the three points by three leveling screws—"f", "f_1", and "1". The arm "b" pivoted at "i" carries a horizontal gauge "c" at its lower end. The gauge "c" is exactly 10 in. from the center of the pivot "i". The indicating pointer "j" moves to the left along the graduated scale "h" when the instrument is in use. The gauge "c" is of glass tubing having a bore of two millimeters. "G" is a compression cock operating on a rubber tube extension from "c", which allows for accurate adjustment of the bubble in the gauge. The level "e" is for horizontal leveling by means of the adjusting screws "f" and "f_1". The level "e_1" is so arranged that it shows a level position when "1" is adjusted with the gauge "c" 1 in. below the position of the pivot "i". In other words, when the instrument is set up the arm "b" has a slant of 1 in. in 10 in.

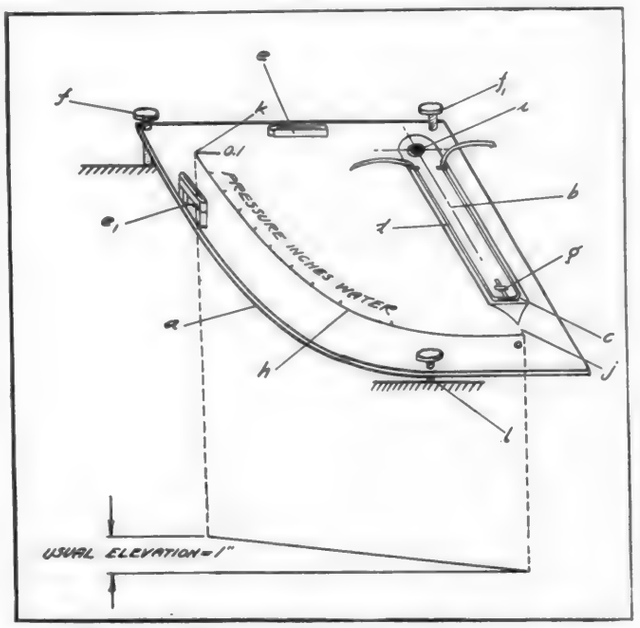


Fig. 41. Design of Quadrant Manometer

For velocity-pressure readings, rubber-tubing connections are made from both ends of the gauge glass "c" to the static and total-pressure sides of a Pitot tube, from the right side of the gauge to the total-pressure side and from the left to the static.

It will be seen from a study of the sketch that, when the indicator is at zero, any pressure in the gauge glass will displace the bubble to the left. The gauge arm "b" is then moved along the scale to the left until the bubble ceases to move. At this point the velocity-pressure of the air will exactly balance the pressure of the liquid in the gauge glass and the pressure in inches of water is read directly from the scale.

ADJUSTMENT OF THE QUADRANT MANOMETER

The important point in adjusting the instrument is to be sure that the bubble in the gauge glass is exactly 1 in. long, as indicated by the marks on the glass. Before using the instrument, approximately 1 in. of liquid is forced into the gauge by operating the compression screw "g". Next, the arm is moved forward and back both sides of zero point until the interior of the glass, both sides of the center, is wetted with the liquid. This is to prevent change in the size of the bubble when readings are being taken. The arm is then set at zero and the bubble adjusted accurately until the meniscus at each end coincides with the marks on the glass. The gauge glass proper is about 3 in. long, giving the bubble a travel of 1 in. either side of the center. When the gauge is leveled for work in its usual position, namely with a slant of 1 in. in 10 in., the entire range of the scale, from zero "j" to the upper limit at "k", is 1/10 in., subject to correction for the specific gravity of the liquid used. The level screw "f" and "f_1", can, however, be adjusted so that the slant is ½ in. in 10 in. which makes the entire range of the scale 0.05 in. of water instead of 1/10 in. This makes it possible to determine velocity pressure as low as 0.0003 in.

Efficiency of the House-Heating Oil-Fired Boiler

Difficulties Which Have to be Met and Overcome in This New Field, Based Upon the Experiences of an Oil-Burning Boiler Manufacturer

By James L. Breese, Jr.,
Breese Engineering Corporation, Chicago

(From a paper read before the American Association of Oil Burner Manufacturers, in St. Louis, April 3, 1924)

BOILER efficiencies in the past have been limited by the necessity of providing sufficient natural draft to give complete combustion of the fuel used for generating the heat.

It has been the aim of coal-burning boiler designers to provide as much surface as commercially possible, but still to allow the flue gases to escape at a temperature sufficiently high to get a good, practical operating draft. We all know that the higher the chimney the greater the draft. Also, that the greater differences in temperature between the outside air and the escaping flue gases, the greater draft on the boiler. This is the fortunate condition under which coal-burning boilers operate, for the lower temperature out-doors the greater draft produced, which makes it possible to burn more fuel at a time when more fuel is needed. This gives the coal-burning boiler its semi-automatic features, or its fortunate condition of stable equilibrium.

There are on the market today a great many so-called gravity oil burners. These burners depend for their operation on the natural draft produced by the escaping gases and operate in a coal-burning boiler, supposedly, in the same manner as solid fuel. The great difference between the use of solid fuel and liquid fuel is, that in the case of coal the amount of fuel burned per unit of time is a function of the amount of heat drawn from the fuel itself to generate the combustible gases, while in the case of liquid fuel the amount of heat generated per unit of time is a function of the amount of liquid metered through some form of regulating valve, all of the fuel delivered per unit of time necessarily being gasified during the same period.

CONDITIONS WITH GRAVITY OIL BURNERS

In the first case, it is quite evident that a change of draft conditions will automatically operate to regulate the amount of gas generated from the solid fuel. The greater the draft, the hotter the fire and, therefore, the more gas generated. In the case of the gravity burner, however, this fortunate condition is reversed and, therefore, the troubles with this type of burner are brought to our notice from time to time.

If a gravity oil burner were properly regulated for a given temperature difference and this temperature difference were changed, the regulation would be incorrect, and if the out-door temperature rose the burner would smoke; if it dropped it would naturally draw a large amount of excess air, possibly to the point of cooling down the burner below the temperature where it would gasify and, finally, extinguish the flame.

DRAFT CONDITIONS LIKENED TO THOSE OF AN AUTOMOBILE

Actual conditions under which house heating must be successful approach those of the automobile, namely, rapid changes in draft conditions at times when it is inconvenient for an operator to be present to make the necessary adjustments, therefore, the carburetion on an oil-burner must be as exact as the carburetion on an automobile and must be either directly proportional to the changes of out-door temperature, or absolutely independent of these changes.

The designers of the first automatic burner chose the latter condition about which to design their burner.

Now, due to this fact, when considering a burner of this type, it is obvious that the previous design of boilers, which was largely based on supplying sufficient and automatic natural draft could be entirely disregarded, and a boiler could be so designed that it could absorb all the heat of combustion, leaving only sufficient heat so that the flue gases would rise up the chimney.

MOST OF THE USUAL DRAFT REQUIREMENTS UNNECESSARY WHEN USING MECHANICALLY-OPERATED OIL BURNER

The average well-built coal-burning boiler is so designed that with a full bed of coals it will give sufficient draft to draw through all the air necessary for complete combustion. This, it is generally agreed, necessitates allowing to escape up the chimney, approximately 30% of the heat generated. In the smaller and less expensive types of boilers, as high as 50% of generated heat will travel up the chimney. By degrees coal prices have gone up and boiler manufacturers have gone the limit in reducing their stack temperatures. They could not, however, reduce them beyond the point where the draft would be insufficient to burn the fuel on the grates.

Now, therefore, what is the condition when an oil burner needing no draft is placed in this boiler? Obviously all the heat which escapes from the boiler and goes into making a draft is a total loss because the draft has already been created by an electric motor. Taking advantage of this fact, we designed a boiler having sufficient surface and of such shape that, for a given amount of fuel, the temperature of

the exit gases would not be greater than 100° above the coolest part of the boiler. Any boiler operating with a burner set at not more than 60% excess air and with a flue temperature of 250° F. loses considerably less than 5% of the total heat generated by the fuel.

EFFECT OF MORE RAPID HEATING IN REDUCING PERIOD OF OPERATION

Up until now we have considered a boiler merely from the point of view of the amount of heat recovered from the products of combustion but this is only a part of the possible efficiencies that can be obtained from a specially-designed boiler for automatic oil burners. Due to the fact, that the designers of these burners preferred to make a device which would burn intermittently at a fixed rate rather than continuously at a variable rate, the consideration of the amount of metal contained in a boiler and the method of applying the heat becomes of prime importance.

If an oil burner operates ten hours a day and burns at the rate of 2 gal. of oil per hour; and if the heat from one boiler can be put into the radiator system six minutes faster than in another, it is obvious that 60 minutes of operation per day is saved; and if there are 150 ten-hour operation days during the year there would be a total saving in oil of 300 gal.

These figures should apply, approximately to a house burning between 2,000 and 3,000 gal. per season; in other words, between 10% and 15% saving.

There are possibly other and better methods of accomplishing this result than those selected by the writer but at the time the simplest method of obtaining this result was to heat the top of the boiler first and pass the gases as they cooled off to the bottom of the boiler. This, as you will readily see, gives a very rapid transfer of heat directly to the radiators as the hottest flame is directed against the outgoing water, and also allows the exit gases to pass over the cold water return on their last pass. There must be a temperature difference between the exit gases and the water to be heated but by passing over the cold water last, we are able to draw the final temperature down to the very lowest point

We have found that 3% or 4% of the generated heat is sufficient to allow the products of combustion to rise and exhaust themselves out of the chimney, and we have also found that it is desirable to radiate from the boiler, approximately, 7% in order to heat the basement. Where pipes are covered, it is sometimes necessary to go even higher than this.

From the figures which we have been able to collect during the last three years, where our boilers have been installed in houses which formerly burned hard coal, we are confident that we are doing the work of a ton of coal with 100 gal. of oil. We have figures as low as 90 and others as high as 110, but the average is safe at 100 gal.

OIL-BURNING BOILERS AS DOMESTIC WATER HEATERS

We all know that a great many and, possibly, the majority, of the purchasers of automatic burners are not interested entirely in efficiencies; they are also interested in conveniences. We found this out very shortly after we had put in our first boiler. The summer came on and we had many requests from our customers wanting to know if they could not use the boiler and burner during the summer to provide them with hot water. They realized they had an automatic heater, which would operate at a cost much less than gas and with far less attention than a coal heater. In one or two cases, we rigged up a system of valves which shut off their radiation system and fed the city supply through their boiler to a storage tank, but the following winter, when they needed heat, they waited until the last minute and, of course, certain connections had to be made and they were not ready to act. Also, we found that during the spring it took several days to get rid of a very disagreeable odor which develops in the radiator water.

Realizing the great demand for a unit system and, also, that we had practically everything in our hands to make such a combination, we tried to figure out how a system of controls could be worked out so that domestic hot water could be supplied while not connecting it to the house-heating system. The result of this investigation was that the simplest method would be to control the amount of heat circulated in the house by a thermostatically-operated valve, and to control the temperature in the boiler by a thermostat which would hold it at a temperature sufficiently high so that an indirect heater, when properly connected, would at all times keep the tank full of water at a temperature sufficient for household use.

The efficiency of such a system is very high during the winter months when the house needs heat and where the radiation from the boiler is desired, but during the non-heating months, when the radiation from the boiler is a loss, the efficiency is not as high as it would be with a smaller heating unit, though the cost is so much in favor of oil over gas that it has been found more than satisfactory. During the summer the average cost of operating an indirect heater from a boiler large enough to heat a house of 1,500 sq. ft. of water radiation only amounts to 50 gal. a month which, at 8c is $4.00, and this for a three or four bathroom house.

EFFECTS OF INCOMPLETE COMBUSTION WITH SMALL FLUE PASSAGES

Any boiler that is designed for oil burning which will reduce the fuel loss to below 5% will, naturally, have small flue passages and will have surfaces of such design that they will give considerable turbulence to the gas, a necessary condition for absorbing heat rapidly, but an unfortunate condition for a burner which does not give complete combustion. Supposing an oil burner is placed in a coal-burning boiler, the flame looks bright to the eye, heats the house well, is fairly quiet, and is giving a very

satisfactory performance. The oil-burner manufacturer is rather pleased with the installation.

A careful examination of the boiler, after several weeks' operation, discloses the fact, however, that there has accumulated on the walls of the gas passages from ¼ to ⅜ in. of "Spanish Moss." The house owner is aware of this and, as stated above, he is getting satisfactory heat, therefore no one considers it but it is there in the case we have selected, nevertheless.

Now let us study the conditions under which this soot was deposited and find out why, if it did deposit ⅜ in., that it stopped there and did not keep on depositing more. After the first layer of ⅛ in. of soot was laid down, this blanket acted as an insulator and the flue temperature was increased slightly; at the increase of the flue temperature, the velocity of the gases increased and, therefore, it took some time to lay down the next ⅛ in. of soot. In time, however, this was deposited; by the time the flue temperature was again increased, together with the natural increase of velocity of the gases; a longer period then followed during which time the last ⅛ in. was being deposited. The more soot deposited, the higher the flue temperature; the higner the flue temperature, the greater the draft.

Finally, the draft had increased to such an extent that the soot in suspension was carried right through with the flue gases and rose out of the chimney and no more soot was deposited on the boiler walls. This is what happens on a coal-burning boiler when operating with the average quiet oil burner, which gives off a small amount of soot with the combustion.

Now in an efficient boiler, either a gas boiler or a boiler especially designed for oil burners, the conditions are just the reverse. The gas passages are relatively small but if properly designed will give the maximum velocity to the flue-gas travel when the surfaces are clean. As soon as soot is deposited on these surfaces, the area between the surfaces becomes decreased to such an extent that the friction loss is greater than the net gain of the higher stack temperature, the result being that the velocity through the passages drops rather than increases, as in the coal burning boiler, and an unbalanced condition is set up in which the more the soot accumulates, the slower will be the gas travel and, consequently, the greater deposit of soot.

From the above it should be quite evident why an efficient boiler is a poor complement to a burner which does not give absolutely complete combustion. There are undesirable features to complete combustion when they are obtained by the various means used in modern burners, namely, noise or vibration, and an intense localization of high temperatures, and at the present stage of oil burning I am not sure but that just as satisfactory a house heater can be built which will smoke slightly as one which gives perfect combustion and has the drawbacks as noted above.

This, naturally, leads me to a discussion of "What is complete combustion" and "How may it be obtained"? As boiler manufacturers we are forced to solve this problem. Out of all the automatic oil burners on the market last year, there were only four that we could recommend as being fit for our boiler. Of these, two gave us trouble occasionally from sooted burners, and the other two were both confined to a high grade of fuel. One of them, of the blower type, while giving complete combustion, has the objection of being noisy; the other is of the straight pressure generator type and, while it is absolutely quiet, is considerably limited in capacity.

Facing these conditions, we were forced to the conclusion that if the oil-burner manufacturers are proceeding along proper lines, then we, as boiler manufacturers, were distinctly on the wrong track. We, therefore, made a thorough investigation of the combustion of liquid fuels to find out what was necessary to produce a smokeless flame and at the time eliminate the usual noise of rapid combustion. This lead us back to a study of what actually happened beyond the nozzle of the oil burner, and what were the various steps through which the oil passed from the liquid to the final state of CO_2.

We found two well-defined steps which were dependent practically on the temperature only. The first was that the liquid fuel had to be changed into the gaseous state before it could be burned. This takes place at, approximately, 700° or 800° F. and necessitates, besides the temperature, the input of sufficient heat to take care of the latent heat of the liquid fuel. This, fortunately, is very low, generally conceded below 200 B.T.U. per pound.

The next stage was to raise this gas to, approximately 1,300° F. in which condition it can be mixed with sufficient oxygen to give complete combustion. In order to make this principle available to all manufacturers of oil burners, we have developed a simple device which can be adapted to most oil burners and acts to eliminate troubles from incomplete combustion, without adding to the noise which has been heretofore an inherent part of an oil burner giving complete combustion in a small space.

This may sound like "blowing our own horn"; in fact, it is and we want to blow it very loud because we are entirely in accord with oil-burning for heating in modern homes and we want to do everything in our power to make the heating device as perfect as possible. For three years we have struggled against odds to produce a more efficient boiler in competition with boiler manufacturers who had hundreds and even thousands of times the available markets in which to sell their product and, after spending this time and money and effort, we are finally faced by the condition which, at least to our minds, proves to us that unless an oil-burner manufacturer can eliminate all trace of smoke from his combustion he is much better off in not using ours or any other highly efficient boiler.

Almost any burner which is mechanically correct and which will give a dependable heat during the winter months can be sold to-day at a fair profit to the manufacturer, but, sooner or later, this condition will end, competition will become keener and then the public will begin to learn there is a vast difference between the burner which heats his house and one which does it efficiently. You can do it efficiently

if you make smoke and you can not adjust your burner so accurately that it will never smoke under all the varying conditions which it must operate.

If you continue to follow along the lines of least resistance and merely design various types of spray guns to throw oil into a furnace, sooner or later you will have to get down to bed rock and find out what goes on during that short period between the liquid and the gas and then so reconstruct your burner that it will carry out these steps in a progressive and orderly manner and will deliver to you a gas which you then can burn in a dozen different ways.

The whole art of gas burning has been thoroughly investigated and tabulated and you may select any one of a number of types of burners now on the market, depending on the type and general construction of the burner you want to produce. We, for our part can show you a very simple method which will make your burner smokeless and noiseless and, while this is well protected by patents, we want every burner manufacturer to avail himself of what we can give, not only for the good of the oil-burning industry in general, but because it will immediately make a market for our boiler, or any one who wants to go into the business of building a really efficient boiler for modern oil burners.

If you want to build gravity or better-termed natural-draft burners, the rate of fuel delivery must be a variable and a function of the draft conditions, or else the draft at the burner must be a constant, but do not bother about boilers any more efficient than the present-day coal boiler. If you want to build an automatic or fixed-draft burner, see to it that combustion is complete before you attempt to use high-efficiency boilers.

Use of a Signal System for Improving Central Heating Plant Operation

By H. A. Woodworth

Superintendent Isolated Steam Plants, Union Electric Light & Power Company, St. Louis

Companies in the district steam heating business can well afford to install a load-indicating device which will enable the engineer to better determine the number of boilers that should be in service at any time. During the cold weather this is not so essential because the load is fairly constant from day to day, that is, the high and low points of the load occur about the same time every day, except Sunday when the load is rather light.

However, during the months of September, October, November, March, April and May an entirely different condition arises. It is during these six months that a considerable saving can be effected through a medium whereby the load can be predetermined within certain limits. During the milder months a building may take steam for only two hours in the morning and about the same length of time in the afternoon.

EFFECT OF SIGNAL SYSTEM IN MILD WEATHER

At this time of the year a number of the larger buildings may shut off their steam at the same time and, if an indicating device of some kind is in operation, the fires can be checked immediately, whereas without an indicator it would be necessary to wait until the pressure started to increase and the boilers pop off. The reverse condition applies when a number of the buildings turn on at the same time, that is, the fires can be pushed a little harder or another boiler can be placed in service before the actual increase in load is noticed at the plant.

The amount of steam taken and the hours of service vary for each kind or type of building. Careful observation will show that heavy loads arise on the mild days that follow a colder, due to the opening of doors and windows, instead of closing the service or radiator valves.

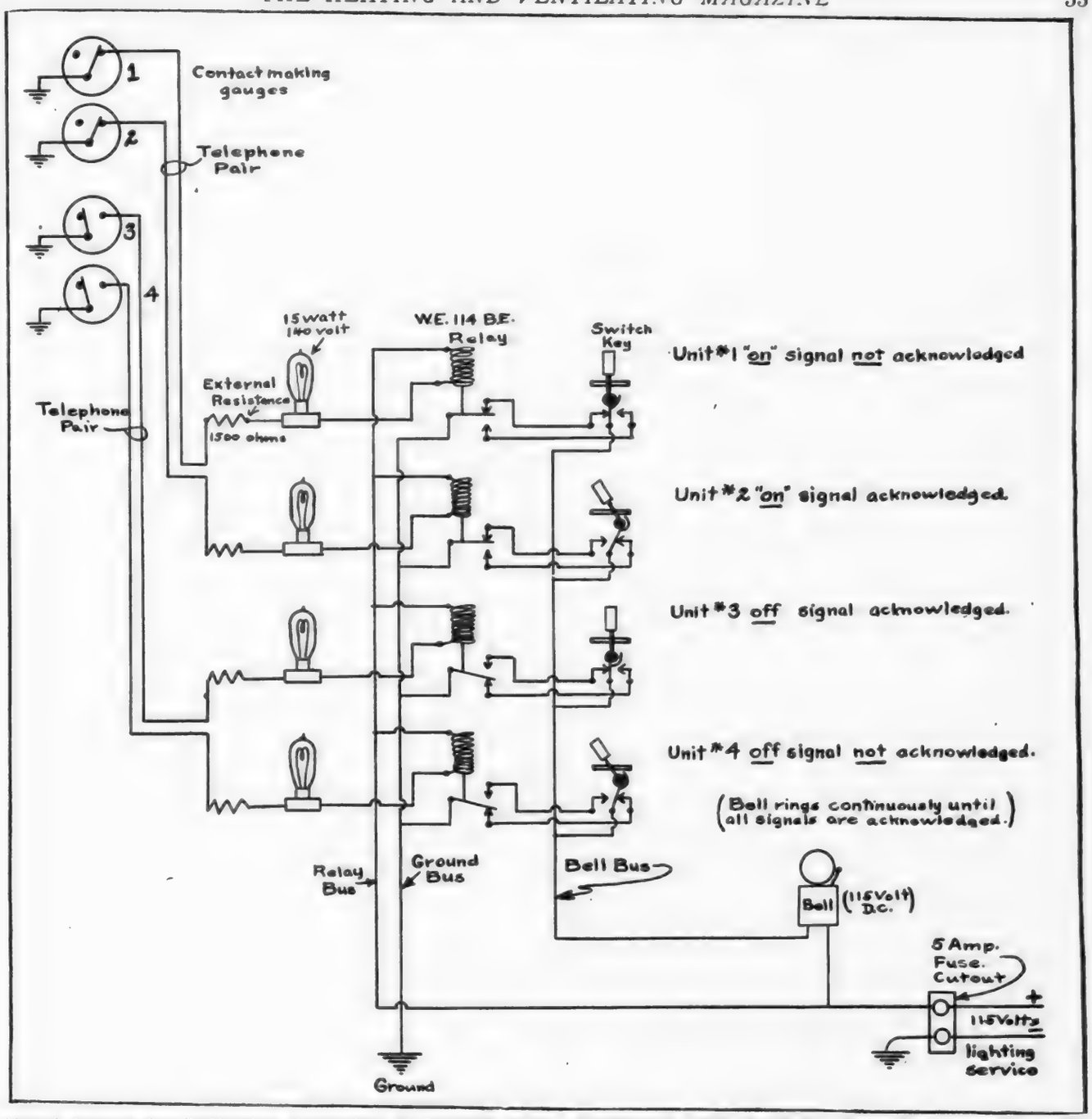
It was this idea that caused the steam heating department of the Union Electric Light & Power Company, of St. Louis, to make an investigation of the various long-distance pressure-recording and indicating devices that are on the market to-day. It was found impracticable to use any type of long-distance recorder and transmitter which required the installation of wires underground, especially when such a recorder, being limited to a certain resistance per wire, made it impossible to use the local telephone company's lines in connecting the instruments. The next best thing to be done was to develop some kind of home-made device that could be operated over the telephone lines. When a new steam distribution system is under construction, signal wires can be placed along with the mains, thereby making it practical to use a standard long-distance recorder.

DESIGN OF LONG-DISTANCE RECORDER AND TRANSMITTER USED IN ST. LOUIS

The load indicator consists of an arrangement whereby the turning "off" or "on" of any one of a large number of buildings is made known to the engineer in a rather forceful manner, that is, by the ringing of a bell and the lighting of the light for that particular building.

Many of the large buildings on this heating system have hydraulic elevators whose power is furnished by steam pumps during the time when heat is, required on the building and by electric pumps during the balance of the time. The exhaust steam from these pumps furnishes steam necessary for heating; therefore, if the engineer knows what pumps are in operation his problem is solved.

In order that this might be done, contact-making pressure gauges were placed in the line between the



Signal System for Indicating Operation of Isolated Steam Equipment with Receiving Units at Central Heating Plant

throttle valves and the high-pressure cylinders. Then, just as soon as any one of the pumps is turned on, the pressure builds up, causing the contacts to close, lighting a light and ringing a bell in the boiler room. The bell is a large signal gong that can be heard very easily in all parts of the boiler room. In order to stop the ringing of this bell it is necessary for the engineer to go to the signal panel and throw the switch for this building to the running or "on" position. He can tell which building caused the bell to start ringing because the signal light will show the building "on" and the switch will be in the "off" position.

When a pump is shut down its light will go out and the bell will begin to ring. In this case the light indicates that the pump is "off" and the switch that it is "on." Then to stop the bell's ringing the switch must be moved to the "off" position.

In cases where the pressure gauges are used to indicate whether the pressure at some important point is above or below some critical pressure, the following holds true. The lamp is burning when the pressure is on or above that point and is out whenever the pressure falls below that point.

There are eleven panels which indicate the operation of the elevator pumps, and two which indicate pressure. One of the pressure panels operates when the pressure at the throttle valve of a very important stand-by engine generator drops below 100 lbs. gauge. Under special agreement the heating company has contracted to furnish 100 lbs. pressure at all times; therefore, this unit is of very great importance. The second pressure-gauge is on a service line to one of the large newspapers where it is necessary to maintain a high pressure in order that the paper might go to press at certain times each day. The steam being used in a drying process, the same high temperature at all times is essential.

A Quick and Useful Horizontal Tank Chart

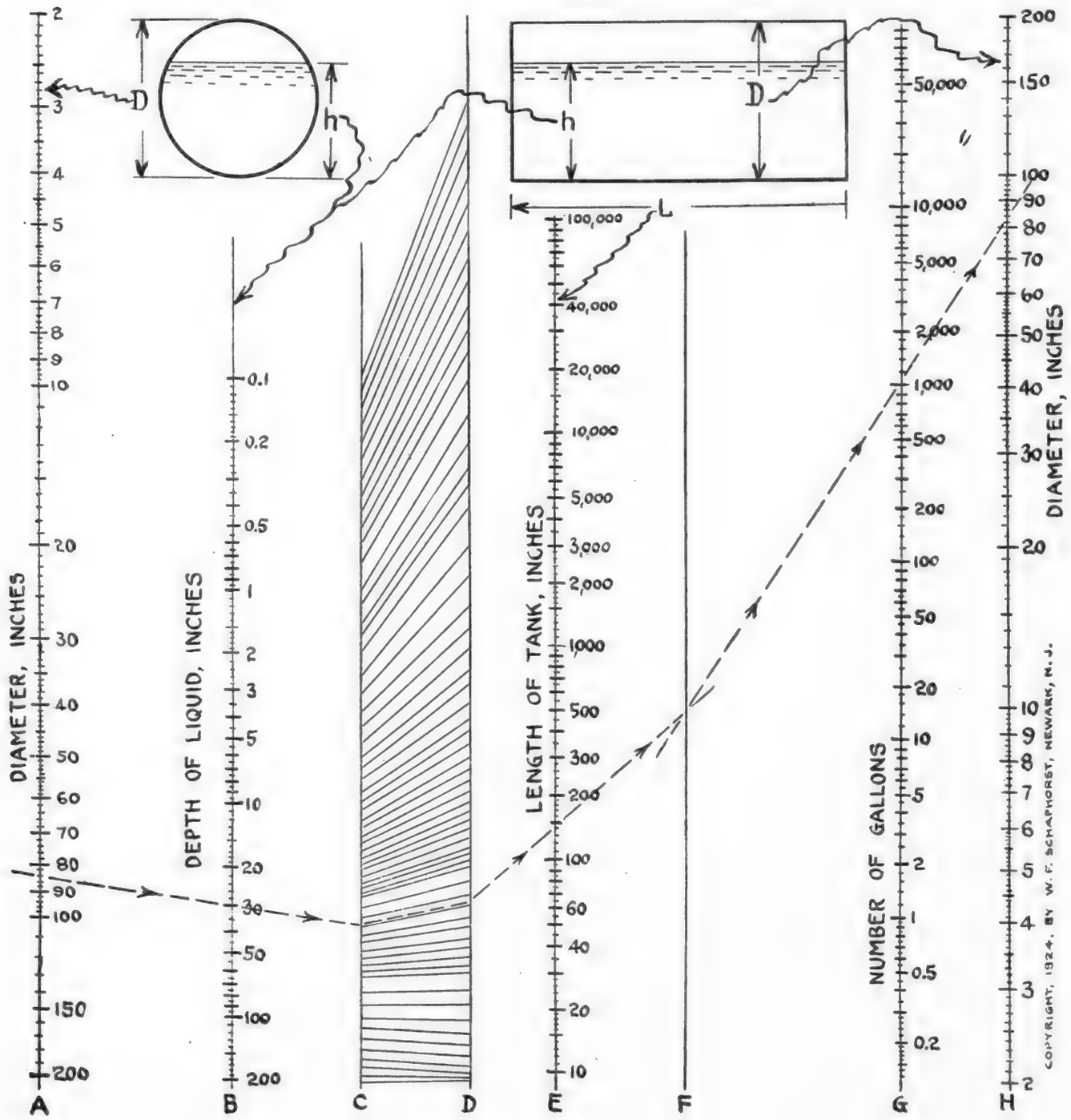
By W. F. Schaphorst, A. S. M. E.

Here is a chart that gives the gallons of liquid in any horizontal tank without the use of tables, formulas, figures, or computations of any kind.

Simply start at the left and zigzag a ruler or thread across the chart three times as demonstrated by the dotted line and the number of gallons is immediately found in Column G. For example: How many gallons in a tank 84 in. in diameter, the depth of liquid being 30 in., and the length of the tank being 142 in.?

Run a straight line through the 84, Column A, and the 30 in Column B and locate the intersection with Column C. By means of the eye follow the radiating "guide lines" to Column D, locating a second point of intersection. From this latter intersection run through the 142, Column E, and locate the point of intersection in Column F. Then from this point run over to the 84, Column H, and the intersection in Column G will be found to be close to 1050 gal., which is the answer.

One of the great advantages of this chart is that it takes care of any depth of liquid from 1/10 in. to the full capacity of the tank. All guess work is eliminated. To make the chart absolutely clear the



writer has included sketches showing the diameter of the tank D, the depth of liquid h, and the length of tank L with wavy arrows leading from them to the proper Columns. By following them no mistake can be made.

The range of the chart is amply wide. It will take care of any diameter from 2 in. to 200 in. and of any length of tank from 10 in. to 100,000 in.

This chart will give an answer more quickly than tables or formula. It is surprisingly accurate. It is more complete than tables because it takes care of every dimension between 2 in. to 200 in. whereas tables generally skip many diameters and lengths.

To avoid confusion all dimensions are given in inches.

Since Column E takes care of lengths of tanks up to 100,000 in. it is plain that not only will this chart compute tanks but it will include long pipes whenever it is desired to compute either the full capacity of such pipes or their partial capacity. 100,000 in. is equal to 8333 1/3 ft.

Inversely the chart may be used very conveniently for determining the length of tank necessary to hold a given number of gallons where the diameter of tank and depth of liquid are known or fixed quantities as is often the case. The method of applying the chart to problems of this character is so obvious that further directions are unnecessary.—*Copyright*, 1924, *by W. F. Schaphorst.*

An Interesting Case of Carbon Monoxide Poisoning

What is described as a very interesting case of carbon monoxide poisoning is reported by Frederick W. Fabian, research associate, in the Department of Bacteriology and Hygiene, Michigan Agricultural College.

"The case in question," states Mr. Fabian, writing in the *American Journal of Public Health*, "had to do with illuminating gas containing a mixture of coal and water gas, and was caused, as nearly as can be determined, by the covering over with earth of the vent pipe leading to the outside of the building from the safety valve on the gas line. The odor of gas was noticeable in late fall and the early part of winter, but no ill effects were apparent.

"On December 21, 1923, the family closed the house for the holidays and did not occupy it again until January 13, 1924, a period of twenty-three days. During this time the weather became much colder and the ground was frozen on the outside around the vent pipe leading from the safety valve.

"The family, consisting of husband, wife and five-months-old baby, arrived home about 6:10 P. M. and noticing the odor of gas opened the door. The man then went to the basement and built a fire in the furnace and kindled a fire in the fireplace. The strong odor of gas being less noticeable the door was then closed. As the house grew warmer, the family began to feel sleepy and by 6:25 P. M. the husband and baby were in a state of partial coma. The wife was in another part of the house, where the concentration of gas was less, and, noticing the condition of the husband and baby, was able to open two windows, pick up the child and go as far as the door when she became unconscious. A neighbor noticing her fall came to the rescue.

"The more common characteristic symptoms of carbon monoxide poisoning present were blurred vision, severe headache, slight nausea, extreme exhaustion, sleepiness and, in the case of the man, weakness in the legs. The man was giving a telephone message when overcome and said he thought he could never get it finished; it seemed to take ages.

"No leaks could be found in the piping inside the house except a defective safety valve which functioned without serious consequences as long as the gas could escape through the vent pipe into the unfrozen ground. However, as soon as the ground became frozen so that the gas could not escape through the vent pipe it was forced back into the house through the safety valve. During the twenty-three days' absence of the occupants the walls, rugs, upholstered furniture, bed clothes, etc., had absorbed the gas and when the house was heated the gas was given off in sufficient quantities to cause asphyxiation.

"To get rid of the gas the house was heated and the doors and windows opened at one-hour intervals for twenty-four hours. An electric fan was also installed to help ventilate the house. All bedding, clothing, mattresses, rugs, etc., were aired out of doors for two days. At the end of this period white mice were brought in cages and allowed to remain over night. One was partially covered with the bedding and was in a state of coma the next morning. Two were bled and a spectroscopic analysis was made. The characteristic carbon-monoxide hemoglobin absorption bands were found in both cases The occupants slept in the house the third night after their return without any ill effects other than a dull headache. The odor of gas remained for a week and caused a burning sensation of the eyes and slight headache to one just entering the house from the fresh air. The symptoms of gas poisoning were particularly evident for three or four days after the attack. There was a fluctuation in body temperature, exhaustion, a burning effect in the lungs, and the victims were easily chilled.

CONCLUSIONS

"1. Vent pipe opening leading from the safety valve on gas piping should never be covered with earth, since freezing may prevent the free escape of gas.

"2. Rugs, bedding, upholstered furniture, etc., are capable of absorbing sufficient quantities of illuminating gas to cause carbon monoxide poisoning.

"3. Any furnished house vacated for any period of time where the odor of gases is perceptible should first be aired thoroughly, preferably for a day or more to drive out the gas from the furnishings, then fires built and the airing continued until tests show the absence of carbon monoxide.

"4. Chemical or physiological tests, or both, should be made by a person competent to perform them before such a house should be reoccupied."

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TWO heating talks broadcasted recently by radio, one on "Getting the Most Out of Your Coal Bin" and the other on "Central Station Heating in Lockport, N. Y." call attention to the enormous opportunities for bringing home to the American public, through this means, a better conception of modern heating and ventilation. In many ways it is almost an ideal method for "getting over" the right kind of information on the subject. It would pay any heating organization handsomely to go into this field on a broad scale and the redounding advantages are almost incalculable in their possibilities.

Of course, any such program of educational propaganda would need to be outlined with care. There would be little use in a haphazard assembly of facts which would leave the hearers with little knowledge that would stick. The important thing, as we see it, is, first, to enlighten the public on the development of the industry from its original status of a plumbing and heating trade to its present status, embracing the two branches of plumbing and heating, and heating and ventilating engineering. The public should be informed of the place occupied by the plumbing and heating trade, and at the same time told of that vast field served separately by the heating and ventilating engineering and contracting industry.

The second important thing would be to let the public know how fully their comfort and health have been provided for by modern heating and ventilating equipment. The functions of vapor heating systems, the thermostatic regulation of temperatures, the supply of fresh air to all sorts of enclosed spaces, what humidity means, and how it can be supplied and controlled, the removal of odors, including kitchen ventilation—these are but a few of the high spots which suggest subjects for effective talks.

We can think at once of numerous organizations that could undertake this work with advantage to themselves and to the industry. We see no reason why this should not be a proper function, for instance, of the American Society of Heating and Ventilating Engineers, the Heating and Piping Contractors' National Association, the National Warm Air Heating and Ventilating Association, especially of its new Educational Research Bureau, and the National Trade Extension Bureau, to mention only those organizations of national scope. When it is considered that a single talk can reach as many as 2,000,000 people, it would seem an opportunity too good to be missed for these and other bodies to work together in planning an educational radio campaign which would help largely in placing heating and ventilation where it belongs in the very forefront of these activities which can do more to raise the standard of comfort and health in America than any other single agency.

ANOTHER convention season has arrived, those of national importance connected with the heating and ventilating industry coming within a few weeks of each other in May and June. It is unfortunate that the dates of two of these organizations will conflict, as both the heating engineers and the central station heating engineers are to hold their meetings on the same dates, one in Kansas City and the other in New York. Details of the heating contractors' convention will appear in the June issue, while the proceedings of the heating and ventilating engineers and of the district heating men will appear in July.

IN RESPONSE to numerous requests we are pleased to announce that the present series of articles on the design of gravity water heating systems, by Professor F. E. Giesecke, appearing in THE HEATING AND VENTILATING MAGAZINE, will be published later in book form and will then be available to all those who have missed the first articles in this series.

FRANKLY acknowledging the difficulties attending the use, on an extensive scale, of fuel-oil burners for house-heating, the fuel-oil burner manufacturers have taken a commendable step in forming a national organization through which the problems involved may be discussed and solutions found, where possible. No one can review the recent convention of the National Oil-Burner Manufacturers' Association in St. Louis, without being impressed with the candor with which the cards were "laid on the table," with a view of starting right, at least, in a field whose extent and importance it is not yet possible to gauge.

Oil Burner Manufacturers Hold First Annual Convention

Makers of Both Industrial and Domestic Appliances Meet to Study the Status of this Rapidly-Growing Industry and to Open the Way for Its Further Progress

HOW rapidly and how far fuel-oil heating has advanced, in both the industrial and domestic fields, was made evident at the first annual meeting of the American Association of Oil Burner Manufacturers which was held in St. Louis, April 1-3. The program was remarkable for the variety of subjects discussed, covering such important topics as standardization in the manufacture of oil burners, temperature and safety controls, natural draft burners and their problems, small pumps for domestic burners, tanks and tank installation, efficiency of the oil-fired boiler, and adapting the oil burner to existing heating plants.

The meeting itself compared favorably with those of much older organizations. There was a wealth of discussion, while the sustained interest manifested throughout the meeting left no doubt of the place which the oil burner manufacturers believe fuel-oil is coming to occupy in the house-heating field. An attendance of over 200 was registered at the convention.

President Wallace C. Capen, of the Home Appliance Corporation, St. Louis, opened the meeting which was held at the Hotel Chase. He emphasized the wonderful progress made by the association during its brief history.

Some interesting suggestions for standardization of product were made by Paul E. Holden, of the Fabrication Production Department of the United States Chamber of Commerce, who presented a paper entitled, "Applied Common Sense in Manufacturing Oil Burners." Mr. Holden showed a series of charts which graphically illustrated the possibilities in the elimination of different products in many industries through the process of simplification, standardization and co-operation. Among the instances he cited was that of the manufacture of water heaters. When standardization of connections had been made, it became possible to accomplish the tapping of the necessary openings at a rate of 1200 heaters an hour, as against 28 heaters before the standardization had been effected.

For the Committee on Underwriters' Standards, P. S. Russell stated that the underwriters for the first time had met with a committee from an association in a spirit of conservation to the end of safeguarding life and property. The committee is to meet again and draft a tentative code which will be submitted to the association.

Discussion of the report brought out the fact that the insurance rates in Milwaukee and Wisconsin had been raised 7% where gravity oil burners were being used for industrial purposes and that an increase in the case of domestic burners was anticipated. Mr. Russell explained that these increases would be made by the local rating bureau of the underwriters' association, and that they were not promulgated by the national body.

As to fire hazards, President Capen stated that the St. Louis Chamber of Commerce, the Safety Council and other interested parties in St. Louis, devised a code for that city which, while not perhaps the best of its kind, could serve as a basis from which work could be started and future progress made. Mr. Chalmers stated that Minneapolis has a local oil burner's association which investigates all local fires from all causes and that, up to date, an insignificant number of fires, were found to be due to oil burners. Further discussion disclosed the fact that on the three coldest days last winter in St. Louis, 231 fires occurred, of which 87% were due to overheated furnaces and only six to oil burner outfits.

SYSTEMATIZING THE NOMENCLATURE OF THE INDUSTRY

For the Committee on Simplification and Nomenclature, G. H. Rittenhouse stated that the findings of the committee revealed such a vast amount of matters to be covered that it was impossible to prepare a complete report in time for the convention. To facilitate matters, the committee decided on a basis for future work, this basis to be submitted to the association for its approval.

The plan provides for four divisions or subjects as follows:

1. Oil Burners.
   a. Natural draft burners.
   b. Forced draft burners.
2. Oil. (Specified terms and grades of oil for use in various types of burners.
3. Oil Accessories. (Need for standardization for tanks, fittings, etc., to prevent necessity, when changing burner, to change also accessories, such as thermostats, etc.).
4. Ordinances and Codes. (The securing of all data possible incident to the subject, to be turned over to the association's Underwriters' Committee).

The committee also recommended that oil-burner manufacturers mark their products much in the same manner as do the electric motor manufacturers, supplying plates, carrying all needed information as to the device.

T. R. Wagner, of the Wagner Motor Company, stated that, sooner or later, the oil-burner manufacturers would have to consult with the Electrical Institute and the National Electric Light Association, with a view of conforming to the respective standards of these bodies and he suggested that the association benefit from the vast amount of information and technical data which these bodies have procured.

GROUP SESSIONS FOR INDUSTRIAL AND DOMESTIC BURNER MANUFACTURERS

The distinction in the fields occupied by the industrial burners and the domestic burners was recognized in the arrangement, on the second day of the convention, for group sessions, Group 1 being for the benefit of industrial burner manufacturers and distributors and Group 2 for domestic burner manufacturers and distributors.

One of the principal papers presented before the domestic burner group was on "Automatic Temperature and Safety Controls for House-Heating Oil-Burners," by H. W. Sweatt, of the Minneapolis Heat Regulator Company.

Temperature and Safety Controls for House-Heating Oil Burners

BY H. W. SWEATT

The remarkable growth of domestic heating by oil in the past three years, declared Mr. Sweatt, can be attributed, to a large degree, to the fact that automatic temperature control makes it possible to have the oil burner completely automatic in its action. A heating plant using coal may require only four or five trips a day to the cellar to adjust the drafts and dampers. Oil, however, with its quickly-generated heat, requires constant vigilance and constant attention unless it is under automatic control. From a safety standpoint, if the drafts are forgotten and left open, while temporary overheating may occur, the coal charge is soon burned up, but with oil, with its large reservoir of fuel and extremely rapid generation of heat, the consequences of forgetfulness are fatal.

From an economy standpoint, stated Mr. Sweatt, automatic control is of vital importance to both manufacturer and dealer. With the awakening of the coal industry to the inroads made by oil, and the propaganda that is being circulated, oil must be an economical fuel to burn to reach the great mass of people. To obtain a quantity production and a large distribution, oil burning costs must meet coal-burning costs on practically an even basis The saving in oil through automatic heat control

is, of course, apparent and appeals to every buyer.

Mr. Sweatt made the additional point that under the present prices of oil, there is a comparatively satisfactory relationship in the cost between oil and coal, but if the use of oil for domestic heating increases as rapidly in the next two years as it has in the past, there is bound to be a marked increase in cost. Already, he added, in 1924, we have seen in the majority of cities the first tendencies in rising prices of oil.

In the average household there is usually no fixed responsibility on any member of the household and no such thing as a constant attendant to watch the heating plant, so that from a safety standpoint automatic control is an imperative necessity. The average oil burner generates an intense heat and should it be neglected and left burning continuously will build up a temperature or pressure at the boiler and through the piping of the system that is dangerous. Thus, without automatic control, if the burner is forgotten, disasterous boiler explosions, fires through overheated chimneys, furnaces and pipes and other casualties, are bound to occur.

TEMPERATURE CONTROL ADAPTABLE TO ANY TYPE OF HOUSE-HEATING BURNER

Temperature control, continued Mr. Sweatt, can be applied to practically any type of house-heating burner now on the market. In some instances, some redesigning of the burner may be necessary. Types of controls to properly equip a burner vary widely, depending upon the design of the burner. For the purpose of his paper, Mr. Sweatt grouped domestic burners in two classifications: (1) the pressure or blower type of burner, employing a mechanical means for the breaking up of the oil, and (2) the so-called gravity burner, which he declared to be more or less of a misnomer, being that type of burner which has no blower, motor or pump attached. This type of burner depends on heat furnished by the burner itself to vaporize the oil and the natural draft of the chimney to draw the air for combustion.

The pressure or blower type of burner was cited as presenting the greatest variety of problems in the application of automatic temperature control and, as a rule, some or all of the following functions of the burner must be controlled:

1. The starting and stopping of the blower motor.
2. The control of oil supply to the burner.
3. The control of ignition means, either gas or electrical or a combination of the two.

CONTROL OF GRAVITY TYPES OF BURNERS

As regards gravity types of burners which usually burns at all times and in which the automatic temperature control functions through varying the size of the burner flame to high or low, this regulation is usually accomplished by a valve placed in the oil supply line to the burner. A properly-designed burner of this type, declared Mr. Sweatt, can be successfully controlled, using the ordinary type of thermostatic equipment generally employed on coal-heating installations, the motor operating and controlling the oil valve. One precaution to be taken by the manufacturer, suggested by Mr. Sweatt, was to be sure that his burner was so designed that it would burn satisfactorily with a low flame, without allowing soot or carbon to accumulate to an unreasonable degree. Such burners should also be equipped with a valve capable of regulation, either manually or thermostatically, between the minimum and maximum flames desired. To effect this control, it is, of course, necessary to arrange for by-passing the minimum supply of oil.

This has often been attempted by providing a by-pass in the oil supply line around a straight shut-off valve which controls the maximum supply of oil to the burner. Mr. Sweatt called attention to what he termed a very serious objection to this arrangement, which was that the by-pass line must be very small, passing through a regulating valve with a very small aperture, and that this line is decidedly liable to clog. Consequently, he stated he had found it much more satisfactory to employ a type of valve which simply closes down the main fuel line to a minimum supply for the minimum flame and as the maximum flame comes on again, the aperture is enlarged and a heavy flow of oil slushes out the passage, preventing this clogging.

On many types of gravity burners, he added, varying somewhat with the type of heating plant, it is also necessary to regulate the amount of draft to the burner for the high and low flame. In regulation this draft supply, he expressed the opinion that more satisfactory results are obtained by using a butterfly damper in the smoke pipe, instead of the ordinary outside check damper. This outside check allows cold air to enter the smoke pipe and this cold air, striking the gas in the stack, chills it, forming soot. This soot gradually retards the draft, resulting in improper combustion and causing the burner to clog with soot and carbon.

Mr. Sweatt urged the use of those types of thermostats which act to automatically lower the temperature at night and raise it again in the morning. He quoted tests which indicated an average saving on a hot water or steam job of between 5% and 7% through the lowering of the night temperature.

After calling attention to the importance of seeing that the thermostat is properly located, this point being fixed at 5 ft. from the floor on an inside wall, and, of course, at some point protected from unusual drafts, Mr. Sweatt urged the practice of installing, in addition to the room thermostat, a boiler hydrostat or pressurestat. This arrangement, he pointed out, gives two independent sources of control.

SAFETY CONTROLS

Aside from the safeties of temperature control, it was pointed out that certain other safeties are essential on the modern burner. First, there must be a positive safety device to shut off the burner in case of any failure of ignition at the starting of the burner in operation. One of the commonest means is to accumulate the oil and flow it back into a drip bucket, cutting off after a sufficient amount of oil has accumulated, either the oil supply or the main power circuit. After such a failure as this, manual attention is required to empty the drip bucket and reset the apparatus. Such a principle was endorsed by Mr. Sweatt as an effective safeguard, providing the drain lines to drain the oil into the drip bucket or other mechanism are so located that they are not subject to clogging up with soot or carbon which may have formed and thereby preventing the oil from reaching the drip bucket.

On certain types of burners, due to their construction, an accumulation of oil is not feasible, and, in some instances, these burners use a pilot light thermostat as a safety device. This thermostat is so designed that in event of the pilot light going out, for any reason, a circuit will be made or broken, as the case may be, shutting off the burner. Many do not feel, added Mr. Sweatt, that a pilot-light thermostat alone is a sufficient safety as this presupposes that, providing the pilot light is burning, ignition is sure to take place.

Another method which, it was stated, operates satisfactorily is to employ a thermostat located so that it is affected by the combustion of the burner. If, after a predetermined interval of sufficient duration to insure ignition, ignition has not taken place, this thermostat will actuate the controlling device to cut off the burner and stop operation until manual resetting is made and the conditions corrected. Mr. Sweatt also referred to a variation where an ignition cycle is started at the time the burner is operated. In case of failure of combustion within a predetermined interval, the device will again operate through its complete ignition cycle.

Safety means to absolutely insure stopping of the burner in case of excessive boiler conditions were declared to be essential. To this end, Mr. Sweatt recommended that, aside from pressure or water controlling themostats, such as are used in dual control, every installation should have an auxiliary device independent of all other controls affected by the temperature at the boiler,

whether steam or water, which, in event of excessive temperature conditions such as might occur by lack of water in the boiler on a steam system or even excess pressures that would definitely cut off the main-line circuit to the motor and the entire apparatus, exactly as the drip bucket does, requiring a manual resetting and examination of conditions. This he declared to be a real final safety on the oil-burner installation greatly benefiting both the burner manufacturer and the owner.

Mr. Sweatt concluded his paper with some suggestions on service and installation, urging the building up of dealer distribution service and installation organization.

The discussion following this paper brought out the point that in selling oil burners, too much emphasis should not be placed on the operating costs, but that instead oil burners should be sold on the basis of cleanliness and convenience.

J. L. Breese, Jr., spoke of the importance of safety and described the effectiveness of an aquastat in the outlet of a boiler, set for a temperature of 250° F. This, he stated, is a positive means of preventing fire and subsequent damage to the boiler through overheating. Mr. Breese also stated that the burning out of boilers is not always prevented by temperature and regulating devices and he stated that all boilers made by his company were equipped with safety switches, 110-volt, set for 250° F. His company, he added, also intends to include with its boilers a fusible plug which will let go at 300°. Pressure control, he said, is not always dependable for steam boilers.

Further discussion brought out the damage resulting to boilers subjected to high temperatures, in driving the water out of the boiler, and the absolute necessity of keeping the water in the boiler. Homer Linn, of the American Radiator Company, related an instance where an oil burner had burned a hole in a boiler large enough for a man to walk through and had done other damage to the extent of $4,000. All of this, he said, was the result of the burner continuing to function until shut off. A new boiler was installed and again, at a later date, it burned out. The owner blamed everything but the right thing for the trouble and finally installed a gas-fired boiler. This will meet the same fate, added Mr. Linn, unless it is provided with absolute safety control.

NATURAL DRAFT BURNERS

Natural draft burners and their problems, were discussed in a paper on the subject by B. M. Oliver, of the Oliver Oil-Gas Burner Company, of St. Louis. This paper stressed the exhaustive research work being conducted by the Oliver Oil-Gas Burner Company on the subject which, he said, has resulted in increased efficiency of this type of burner. At the conclusion of his paper, Mr. Chalmers raised the point that in the absence of the owner, with a draft burner, when a weather change took place, its effect on the draft made the burner a smudge pot, with attendant dissatisfaction. Mr. Breese stated that this was most unlikely since an increase of wind or draft results in an increase of heat by the down-draft action of the chimney, the opposite change resulting in a lower fire and lower fuel consumption. Mr. Meckle, who presented the paper for Mr. Oliver, stated that under all conditions the draft burner developed 76% efficiency. Mr. Chalmers expressed the belief that high winds would, at times, prevent suitable draft, whereupon Mr. Linn stated that over 75% of boiler complaints are due to insufficient draft. Mr. Breese stated that it was a simple mechanical problem to make efficient draft burners. The discussion was closed by Mr. Meckle stating that at 0.05 in. draft the burner has developed its maximum efficiency.

Another subject taken up at this group session was "Small Pumps for Domestic Burners." A paper on the subject by J. H. Haberly emphasized the advisability of using pumps that were self-priming and so constructed that all wearing parts could be easily and conveniently replaced. Mr. Schurig asked the speaker what, in his opinion, was the best type, since Mr. Schurig, in the merchandising of over 20,000 pumps, had used rotary, piston and centrifugal types with varied success. Mr. Astrom stated that, in his opinion, piston pumps were the best, the objection to rotary pumps, he believed, being due to the hand-operated types which did not develop sufficient speed to create the necessary vacuum.

"Portable Oil-Burning Equipment," the title of a paper by W. G. Barstow, related the many uses, outside of house-heating, to which oil has been successfully applied. The market, he said, is waiting for a burner of the nozzle or torch type that can be carried about at will, and he mentioned the great economies effected by railroads and others with this type of burner in making repairs.

"Tanks and Tank Installations," was the subject of a paper presented by R. Schurig, of the Chicago Steel Tank Company. Mr. Schurig stated that the production of tanks by his company had increased from 22 in 1917 to 4,600 in 1922, and that in 1923 10,000 tanks had been made and sold by his company for oil-burning purposes. The total tank gallonage in Chicago alone for 1923, he said, was 10,000,000. His company has many papers and other data which are available upon request and he urged the association to inform dealers on tank requirements and installation methods.

In answer to a question at the close of his paper, Mr. Schurig stated that, in his experience, the best coating for joints and threads was a thin application of orange shellac, despite the objections of the underwriters to this practice. In answer to questions on tank coating, Mr. Schurig stated that red lead and oil had proven superior to ordinary asphalt, which had been used up to six years ago. He added that the life of a tank was comparatively estimated by the Bureau of Standards to be 30 years, but that, in his opinion, a tank would last 60 years when buried in sand and clay. His company, however, would not guarantee the life of a tank embedded in concrete. The point was raised that in New England and other places, the ordinances require a tank to be buried in concrete when placed close to a building. This, the speaker stated, was to discourage the placing of tanks in close proximity to buildings, and he added that during the war, when steel and metals were scarce, his company contemplated building concrete tanks, but dropped the matter when investigation proved it to be impracticable.

"Industrial Oil Burning on the Pacific Coast" was the subject of a paper by J. C. Johnson, of the S. T. Johnson Company. With the use of a chart, Mr. Johnson gave a detailed description of the costs of installation of various burners for all types of buildings on the Pacific coast and the reduction of these costs as experience was acquired, with a decided increase in efficiency. As an illustration, he pointed out that, at first 2-H.P. air compressors were used for certain conditions which, at a later time, was replaced, for the same conditions, by a 1-H.P. air compressor.

"Time Payments on Heating Equipment," by Lawrence Scudder, of the Consolidated Finance Corporation, related the experience and methods of selling automobiles through time payments, but qualified the comparison to heating equipment by the statement that oil burners do not have a ready second-hand market. The question of the recovery of equipment not paid for was brought up in the ensuing discussion. T. A. Mack stated that burners installed could be interpreted as part of the realty in several States and, as such, could not be removed. In Kansas City, it was brought out, oil burners are being sold on chattel mortgages which protect the dealer to the same extent, in the matter of recovery, as furniture and other dealers are protected who sell on the part-payment plan.

MOVEMENT TO CONDUCT EDUCATIONAL CAMPAIGN

"Co-operative Advertising of Oil as Fuel," was discussed by W. M. Horner, of the Mahr Mfg. Company. Mr. Horner emphasized the necessity of having proper oil-burning equipment, and he suggested that a committee be formed from the oil industry, the oil burner manufacturers and the various affiliated industries, to map out a definite and intelligent method of procedure. Mr. Horner used a chart

suggesting the personnel and scope of a proposed bureau to prepare and conduct a comprehensive educational campaign on oil as a fuel. He proposed that the bureau be under the administration of a board of directors composed of nine oil men and six burner manufacturers, and that the bureau staff be composed of a director, oil expert, chemist, metallurgist, plant equipment engineer, house-burner engineer, boiler-burner engineer and a clerical force.

To raise the necessary funds, Mr. Horner suggested that each oil-burner manufacturer contributed 50 cents per $1,000 of sales, with a minimum contribution of $100.00 and he closed his talk with a plea for prompt and definite action.

Homer Linn suggested that the matter be submitted to the board of directors and Mr. Bailey closed the discussion by stating that, owing to the brief history of the association, despite its rapid progress, it was not quite ready to take definite and prompt action on such a huge undertaking.

An important paper by Henry L. Doherty on "Co-ordinating the Oil and Burner Industries" which was presented by Richard Wollowitch, expressed the belief that there is an abundance of oil for some time to come to care for the oil-burning industry and it was urged that the manufacturers and dealers work for a condition of having burner owners lay up supplies of oil in the summer months to prevent unusually heavy demands during the heating season. Mr. Doherty's paper emphasized the need of all possible precautions to make burners safe and suggested the formation of local clubs throughout the country to work for reasonable restrictions regarding the storage and use of fuel-oil, in an effort to offset the imposition of drastic regulations. Other suggestions contained in Mr. Doherty's paper were that the manufacturers should secure records of fuel requirements for past seasons to guide them in estimating the oil demands for the next year, and that the practice of installing large tanks should be advocated, to offset the hardship worked upon the oil distributors through the delivery of small quantities of oil at a loss.

"The Significance of Underwriters' Standards," was discussed by E. J. Smith, of the Underwriters' Laboratories. Mr. Smith stated that as far back as 1902 the underwriters made their first regulations on oil burners and that the need for installation regulations was paramount. He urged that all information possible be furnished municipalities and other code-making bodies and that no one should install burners where there are defective boilers, furnaces, flues or chimneys.

In the ensuing discussion, mention was made of several instances where existing regulations were inconsistent and unduly severe. The discussion also brought out the point that the best method of making a smoke test was to seal the chimney and burn a quantity of tar paper in the fire box.

Much interest was manifested in a paper by Wallace C. Capen, of the Home Appliance Corporation, on "Putting Sales Service and Dealer Relationship on a Sound Basis." This paper contained some interesting suggestions on installation and service to be rendered. Mr. Capen approved the plan of having a heating engineer inspect each prospective installation and, if acceptable to him, the burner would be installed on his responsibility. In the event of the engineer's investigation finding any weakness in any part of the complete heating system, these weaknesses would have to be corrected before installation of the burner and no burner should be installed where it could not operate with maximum efficiency. If conditions were such that a particular burner could not function properly, Mr. Capen urged that the dealer for this burner withdraw and turn over the order to the dealer whose burner could be installed to better advantage. Mr. Capen emphasized the need for an understanding with the owner at the time of purchase as to the service policy of the dealer and mentioned several service plans, among which was a service charge based on zones in ecrtain localities, while another plan was a flat price for a book of service tickets or call tickets.

"Efficiency from the Oil-Fired Boiler" was a timely topic discussed by J. L. Breese, Jr., of the Breese Engineering Company, Chicago. This paper is presented on another page of this issue.

An important paper on "Adapting the Oil Burner to Existing Heating Plants," by Homer Linn, of the American Radiator Company, is also presented on another page of this issue.

"Checking the Warm-Air Installation," by E. B. Langenberg, president of the National Warm-Air Heating and Ventilating Association, after describing the development of the code for installing warm-air furnaces in residences, offered the following items as matters which should be checked before installing an oil burner in a warm-air furnace:

1. The smoke-pipe damper should be in working order.

2. All joints on the heater should be cemented tight. The casing be removed and the entire heater re-cemented.

"I have heard reports," concluded Mr. Langenberg, "that in cast-iron furnaces cement has been known to pulverize and blow out of the joints. In steel furnaces, it is occasionally melted out. What the answer is to this, I don't know. It has been stated that some 2,000° F. are generated by an oil burner and this exceedingly high temperature is undoubtedly causing a tremendous expansion and contraction in the heating apparatus. Ordinary temperatures, when coal is used run between 800° and 1,200°. This is a matter for thought and should be watched carefully by installers of oil burners.

"It can be readily seen that the heater must be cemented tight so as to eliminate any possibility of odors being carried up to the rooms through the air ducts.

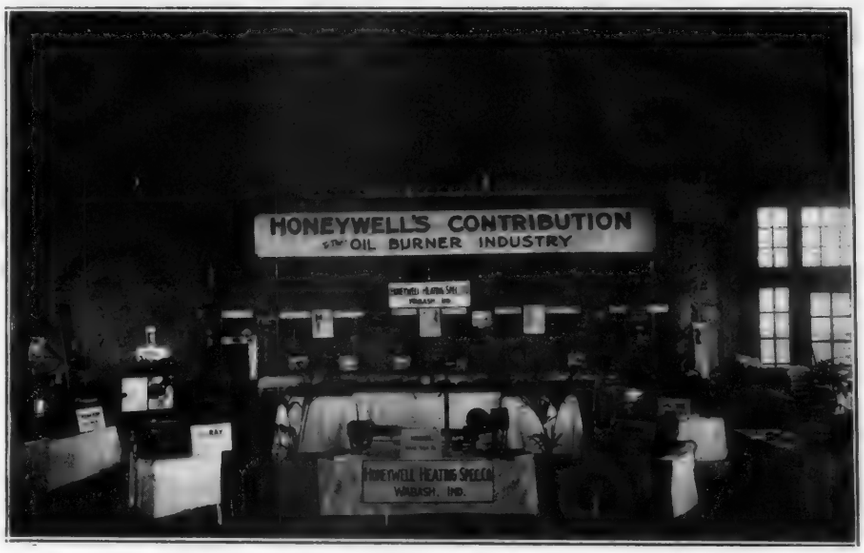
"I think that the oil burner should be movable on quick notice, should a shortage of oil or any other cause create the necessity for the temporary use of coal."

Subjects of other papers presented at the meeting were: "Fuel Testing Plant at the Philadelphia Navy Yard," by R. C. Brierly; "Canadian Problems and Developments in Oil Burning," by Lionel L. Jacobs, of the Fess Oil Burner of Canada, Ltd.; and "Oil Burners Under Oil Refinery Stills," by Edward P. Bailey, of the National Airoil Company.

The new officers of the association are: President, Edward P. Bailey, National Airoil Co., Philadelphia; vice-presidents, Ernest H. Peabody, Peabody Engineering Corporation, New York; L. P. Ordway, Jr., Winslow Boiler & Engineering Co., Chicago; A. M. Lockett, A. M. Lockett Co., Ltd., New Orleans, La.; J. T. Voorheis, Coen Co., San Francisco, Cal.; and Lionel L. Jacobs, Fess Oil Burner of Canada, Ltd., Toronto, Can. Directors: W. C. Capen, Home Appliance Corporation, St. Louis; C. E. Chalmers, Chalmers Oil Burner Co., Minneapolis, Minn.; R. P. Flower, Gill Mfg. Co., Chicago; John Sheminger, Jr., Aetna Automatic Oil Burner Co., Providence, R. I.; and A. H. Tiffany, Tiffany Oil Burner Co., Paterson, N. J. The secretary and treasurer of the association is Leod D. Becker, editor of *Fuel Oil*, Galesburg, Ill.

The Exhibitors

Among the exhibitors were the Minneapolis Heat Regulator Co., Minneapolis, Minn.; C. U. Williams & Son, Bloomington, Ill.; Home Appliance Corporation, St. Louis; Wayne Electric Co., Wabash, Ind.; Gill Mfg. Co., Chicago; Winslow Boiler & Engineering Co., Chicago; S. T. Johnson Burner Co., Oakland, Calif.; Adams Rotary Pump Co., Cleveland, O.; Fort Wayne Engineering & Mfg. Co., Fort Wayne, Ind.; Subrasco Tiffany Oil Burners (Superior Brass Mfg. Co.), Paterson, N. J.; Jefferson Electric Co., Chicago; Century Electric Co., Chicago; Chicago Steel Tank Co., Cicero, Ill.; American Blower Co., Detroit, Mich.; Janette Mfg. Co., Chicago (motor for oil burners); Basel Mfg. Co., Kansas City, Mo. (oil burner control valves); Cook Electric Co., Chicago (automatic oil pumps): Milwaukee Tank Works, Milwaukee, Wis.; Breese Engineering Corporation, Chicago; Oliver Oil Gas Burner Co., St. Louis; Blackmer Rotary Pump Co., Petoskey, Mich.; Leader Iron Works, Decatur, Ill.; The Ohio Electric Controller Co. Cleveland, O.; Hart Oil Burner Co.



Corner of Exhibit Hall, Convention of American Association of Oil Burner Manufacturers

Peoria, Ill.; Federal Gauge Co., Chicago; C. J. Tagliabue Mfg. Co., Brooklyn, N. Y.; American Nokol Co., Chicago; Scott-Newcomb Automatic Oil Burner Co.; Allen & Lee Mfg. Co., Wichita, Kan.; Sherman Oil Burner System, Worcester, Mass.; Ray Oil Burner Co., San Francisco, Calif.; and Schubert Christy Con. & Mach. Co., St. Louis.

Proposed Simplification of Gasoline and Fuel-Oil Tanks

Due to the initiative of the Division of Simplified Practice of the U. S. Department of Commerce, in Washington, representatives of tank manufacturers and users, at a meeting held in Washington, March 13, discussed the possible reduction in variety of sizes of gasoline under-ground, also fuel-oil and distillate, storage tanks.

A review of manufacturers' lists showed from 30 to 150 different types, sizes, and capacities of tanks for these several purposes. Some of the larger users had sent in data showing they required for their purposes only a few of the sizes offered. It was the consensus of opinion that a reduction in current variety would be of very definite advantage to the manufacturers, distributors, and consumers. After discussion of sizes in most common use, the conference proposed the following as its tentative "Simplified Practice Recommendations."

Above, and Below-Ground Storage Tanks for Gasoline, Oils, and Volatile Liquids.

Sizes denoted by capacities in U. S. Gallons.*

280	4,000
550	5,000
1,000	10,000
1,500	12,000
2,000	15,000
3,000	20,000

Capacities are nominal;—a variation in actual capacity of not more than 5% over or under the nominal capacity is permissible.

The conference recommends to tank manufacturers, oil-burner manufacturers, fire departments, the National Fire Protection Association, and the National Board of Fire Underwriters that a man-hole be installed in all fuel-oil storage tanks of 1,000 gal., or greater, capacity, to provide for cleaning-out, and to thus increase safety. The conference went on record as being very willing to coöperate with these associations in making this a standard component of these tanks.

These recommendations are to be sent to all interested parties for review and comment. A general conference of all interests is planned to be held later in the year, for the purpose of securing adoption of these and other pertinent recommendations. Those present unanimously agreed that simplification of present diversity to the list proposed would bring great benefits and economies to all concerned, and urged that all manufacturers and users of these tanks support this constructive effort.

*These sizes apply to tanks shipped assembled.

District Heating Talk Broadcasted by Radio

A series of four talks on "District Steam Heating in Lockport, N. Y.," was recently broadcasted from Radio Station WMAK, Lockport, N. Y., by George H. West, secretary of the American District Steam Company.

Mr. West's talks presented in an interesting way how Lockport, N. Y. happened to be the first city in the United States to enjoy the comforts and commercial advantages of securing steam heat from a district plant in 1877; also how the system had been extended and improved from time to time, due to the growth of the city of Lockport and the improved methods of carrying the steam underground.

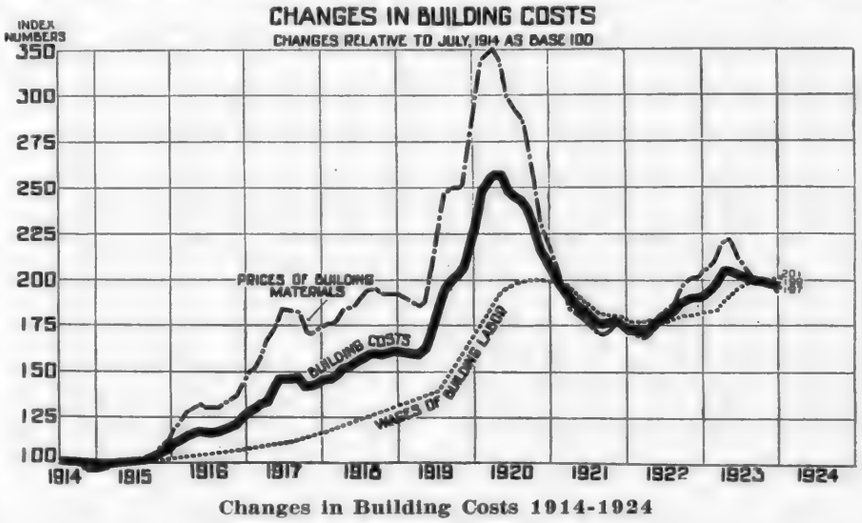
Copies of these four papers are available upon application to Radio Station WMAK, Lockport, or to Mr. West at North Tonawanda.

New Data on Comparative Building Costs

Using the costs on July 1, 1914 as the base, the National Industrial Conference Board, recently completed a study of the cost of construction in the United States, which shows that costs have doubled during the last ten years. The board's chart discloses that while wages are now as high as at the peak period of prices, other factors have shown considerable reduction from the peak reached early in 1920.

The board's study shows that prices of building materials until recently more than kept pace with the rise in wages. From 1915 to 1920 the prices of materials increased more than twice as much as wages. In 1921 materials costs fell to approximately the same levels as wages. During the past year the present 100% increase over 1914 in both wages and materials was established.

The general trend of building costs, taken as a whole, as shown by the nation-wide survey, is a tendency downward for materials and a rising tendency for wages.



Changes in Building Costs 1914-1924

National Warm Air Heating and Ventilating Association Launches Its Educational Research Campaign

Probably the most ambitious movement ever inaugurated in the warm-air furnace heating industry was definitely launched at the eleventh annual convention of the National Warm Air Heating and Ventilating Association, in Cleveland, Ohio, April 16-17, when the organization of the association's Educational Research Bureau was decided upon and a sum of money appropriated for the initial expenditures during 1924.

Plans were also exhibited of the association's Educational Research House which is being built by the association and which will be used for conducting "field" tests of warm-air furnace heating systems under widely-varying conditions. Studies will be made in this residence, for instance, of:

1. The effect of wind.
2. The relative value of inside and outside air supply.
3. The significance and proper percentage relative humidity in the house.
4. The variation of air temperatures from floor to ceiling in actual rooms with different air temperatures at the registers.
5. The proper location of furnace with respect to center of basement.
6. The relative value of return air ducts above floor compared with ducts placed below basement floor.
7. The proper location and number of recirculating registers.
8. The proper location of warm air inlet registers.
9. The effect of various installation details on operation of wall stacks to upper floors.
10. The effect of various installation details on operation of basement pipes.
11. The relative value of inside as compared with outside chimneys.
12. The importance of constant temperature both day and night.
13. The problem of the remote room or the room with three sides exposed.
14. The proper installation for a sun porch.

The house will also afford a most unusual opportunity to check up many of the requirements of the new Installation Code.

The meeting of the association was held at the Hotel Winton, Cleveland, and was opened by President E. B. Langenberg. In his annual address, President Langenberg referred particularly to the latest research bulletin (No. 141), issued by the University of Illinois in connection with its co-operative agreement with the association. This bulletin was characterized by President Langenberg as the culmination of six years of effort in connection with furnace heating research work.

Speaking of the growing use of oil-burners in warm-air furnaces he said:

"The introduction of a new industry into the field of commerce, substituting oil for coal as a heating medium, is one in which we are all directly interested. They, on their part, are going through a formative and development period of which the future alone will show either progress or oblivion. . . . After hearing their discussions, I am of the opinion that, while at present they are really making progress in an individual way, they are still traveling in the dark. The public, as usual, is paying for the experience and the experiments, but as the public is also demanding basements free from ashes and coal dust and a system that will run itself, they are willing to pay.

"Our industry cannot at the present time obligate itself to oil-burning until this new business has proved its justification in fact and not sales arguments."

Mr. Langenberg expressed the opinion that oil-burners can be made to operate satisfactorily in warm-air furnaces, and that the field for the sale of oil-burners for use in warm-air heaters is far greater than in any other branch of heating.

REPORT OF SECRETARY WILLIAMS

Secretary Allen W. Williams reported the industry to be in a healthy condition. In deference to federal interpretations of the law regarding collection of statistics by associations, no attempt had been made during the past year to compile figures on the percentage of increase or decrease in the total number of furnaces, pipe, pipeless and room heaters sold during 1923, as compared with the previous year. Secretary Williams reported a sustained demand for copies of the Standard Code for the Installation of Warm-air Furnaces in Residences, the demand often exceeding the supply.

CONTRACT WITH UNIVERSITY OF ILLINOIS RENEWED

For the executive committee, Chairman I. L. Jones reported that the present contract with the University of Illinois in reference to research work had been reaffirmed for the ensuing fiscal year.

Action regarding the association's Educational Research Bureau came up when E. F. Glore reported for the special committee on trade extension. He offered the following resolution which was adopted by the meeting:

"Resolved, that a committee of five be appointed by the chair to organize the Educational Research Bureau for the purpose of giving publicity to the work of the Educational Research Laboratory at Urbana, Ill.;

"That this committee be empowered to expend not more than $2500 between now and the next annual meeting of the association;

"That the monthly bulletin (of the association) be authorized for circulation among our salesmen at a price of ten cents per copy."

EDUCATIONAL RESEARCH RESIDENCE UNDER CONSTRUCTION

The progress to date in the construction of the association's Educational Research Residence was presented by Chairman Clarence M. Lyman of the Advisory Committee on Research. Bids were received and considered at a meeting of the advisory committee on March 25, the lowest estimate being $17,000; it is anticipated, however, that there will be some extra costs bringing the total somewhat above that figure. This bid was accepted and work has already commenced on the construction of the residence.

A number of papers on topics connected with warm-air furnace heating were presented, notably one by A. M. Daniels on "Education and Its Relation to Better Heating" and one by Edwin S. Hallett, chief engineer of the St. Louis Board of Education, on "The Use of Ozone in Residence Heating."

All of the officers were re-elected with the exception of Vice-President Edward Norris, whose other duties prevented him from serving again. The new list of officers is as follows:

President, E. B. Langenberg, St. Louis; vice-president, Richard C. Cook, Newark, N. J.; secretary, Allen W. Williams, Columbus, O.; treasurer, W. P. Cooke, Monroe, Mich.

Executive committee: Irving L. Jones, Utica, N. Y.; D. Rait Richardson, New York; J. V. Patten, Sycamore, Ill.; H. Burinson, Hamilton, Ont.; W. H. Hill, Elyria, O.; and John Frey, Detroit.

Announcement was made that the Educational Research Bureau Committee for the ensuing year will be composed of E. F. Glore, chairman; George Harms, Roy C. Walker and Mr. Bridge.

Broadcast Second Address on House Heating

The second of the series of talks on house heating by E. F. Glore, treasurer and general sales manager of Abram Cox Stove Co., Philadelphia, was broadcast by Station WFI recently. The subject of this address was "Comfortable Heat in Every Room."

Mr. Glore prefaced his talk by the statement that many persons who heard the first address had written that very often one room in the house or a certain part of the house would not register the required temperature. He said that this frequently is caused by too small a pipe or radiator, however, that is not always the cause and it is advisable to call in a heating expert just as you would call a doctor in case of illness.

It is not the kind of heating system one has, but proper installation and size that counts in making the house comfortable, Mr. Glore stated. He urged also that home owners have their heating plants overhauled, or at least examined, periodically.

Mr. Glore's first talk, on "Getting the Most Out of Your Coal Bin," has been published in booklet form for free distribution.

American Society of Heating and Ventilating Engineers

Program for Semi-Annual Meeting

Preparations are practically completed for the semi-annual meeting of the American Society of Heating and Ventilating Engineers in Kansas City, Mo., June 10–12. The fact that it is to be held so much farther west than usual and western members, most of whom have never before attended a general society meeting and who will thus give a decidedly western flavor to the proceedings. Headquarters will be at the Hotel Muehlebach.

Following is the tentative program:

MORNING SESSION, TUESDAY, JUNE 10.

Business session, including address of welcome, address of president and committee reports.

Paper: "Using By-Products in Flour Mill for Heating and Humidifying," by E. K. Campbell.

AFTERNOON SESSION, TUESDAY, JUNE 10.

Paper: "Determining Dry-Return Proportions," by R. V. Frost.

Paper: "Performance of a Warm-Air Furnace with Anthracite and Bituminous Coal," by A. P. Kratz.

Paper: "Selecting Wall Stacks Scientifically for Warm-Air Heating Systems," by V. S. Day.

(At the conclusion of this session the convention party will be taken for an automobile trip. In the evening there will be an informal reception and dance).

MORNING SESSION, WEDNESDAY, JUNE 11.

Paper: "The Commercial Value of Heating and Ventilating Research to the Engineer," by F. Paul Anderson.

Paper: "A Simple Method of Using the Kata-Thermometer to Show the Effect of Air Motion on Human Beings," by Margaret Ingels.

Paper: "Effective Temperature Applied to Industrial Ventilating Problems," by C. P. Yagloglou and W. E. Miller.

Paper: "A Study of the Correlation of Skin Temperature to Physiological Reactions," by W. J. McConnell and C. P. Yagloglou.

Paper: "The Heat Given Up by the Human Body and Its Effect on Heating and Ventilating Problems," by C. P. Yagloglou.

Paper: "Some Additional Information Concerning Air Leakage Around Window Openings," by C. C. Schrader.

Paper: "The Flow of Steam and Condensation as Affected by High Pressures, Horizontal Offsets and Valves," by Louis Eben and R. L. Lincoln.

Paper: "Practical Applications of the Heat Flow Meter," by P. Nicholls.

AFTERNOON SESSION, WEDNESDAY, JUNE 11.

Discussion of Proposed Code of Minimum Requirements for Heating and Ventilating Buildings, led by L. A. Harding, general chairman.

(During the afternoon a golf meet has been arranged, followed, in the evening, by a dinner and entertainment for the society).

MORNING SESSION, THURSDAY, JUNE 12.

Continuation of Discussion of Proposed Code of Minimum Requirements for Heating and Ventilating Buildings, led by L. A. Harding, general chairman.

AFTERNOON SESSION, THURSDAY, JUNE 12.

Paper: "Ozone and Its Use in Ventilation," by Frank E. Hartman.

Paper: "Modern Trend in the Art of Ventilation," by Perry West.

Paper: "Some Comments on Present-Day Heating and Ventilation," by W. S. Timmis.

Under the direction of a general committee of Kansas City members, headed by John H. Kitchen, a warm welcome and delightful entertainment program is being arranged for those who attend the convention. In addition to the entertainment features already mentioned. there will be a full program for the visiting ladies, including an automobile ride with luncheon at one of the country clubs, on Tuesday afternoon, and a luncheon at one of the down-town clubs on Thursday.

New York Chapter Hears Talk on Manufacture of Copper and Brass Indirect Heaters

The inside story of the development of the new type of copper and brass indirect heaters recently placed upon the American market, was told at the April Meeting of the New York Chapter, held at the Building Trades Club, April 21. The speaker of the evening was Lawrence C. Soule, secretary of the Aerofin Corporation, and his talk was devoted to the Aerofin heater, with which he has been closely connected from its inception.

Mr. Soule's talk was illustrated by lantern slides in which each step in the design and construction of the heater was presented in detail. Mr. Soule explained the provisions which had been made for expansion and contraction of the tubes, the means taken to make the heaters sufficiently rugged and the unit arrangement used whereby they may be built up like a sectional bookcase. Impressive figures were presented regarding their weight and size for given duties, compared with the older forms of cast-iron radiation. Another interesting point brought out was the means taken for tinning the surfaces and joints so as to eliminate the possibility of corrosion.

Samples of the principal parts of the heater, with its extended fin surface, were passed around and aroused much interest. The ensuing discussion, which was lively and prolonged, gave further evidence of the interest in this form of heater.

During the business session a resolution expressing the feelings of the chapter in the death of Frank K. Chew, offered by A. S. Armagnac, chairman of a committee to draft a suitable resolution was adopted by rising vote. The announcement of the death of the father of William J. Olvany was followed by a similar resolution of sympathy, offered

Left to right—Carl Clegg, secretary, Kansas City Chapter; Walter E. Gillham, president, Kansas City Chapter; N. W. Downes, R. M. Stackhouse, C. A. Burton, Raymond Bidwell, E. C. Harbordt, John B. Fehlig, Linn W. Millis, Benjamin F. Cook and John H. Kitchen, general chairman.

Kansas City Chapter Members Who Will Handle the Ways and Means Program at the Society's Meeting in Kansas City

by William H. McKiever, also adopted by rising vote.

The ballot for officers resulted in the election of the following:

President ,William J. Olvany; vice-president, A. A. Adler; secretary, Edward B. Johnson; treasurer, F. E. W. Beebe. Board of governors: W. L. Durand, R. A. Wolff and M. W. Ehrlich.

The secretary's report showed an average attendance at the meetings this season of 86. The total membership of the chapter has increased 58% during the year. Finally, Treasurer Beebe, in his report, reported a balance on hand at the close of the year of over $500.00.

Plans are going forward to make the May meeting a gala event, with special entertainment features.

Illinois Chapter Discusses Gravity Water Heating

Gravity-flow water heating systems and methods for their design, based upon recent researches, was the subject of an address by Professor F. E. Giesecke, of the University of Texas, at the April meeting of the Illinois Chapter, held at the Chicago Engineers' Club, April 14. Professor Giesecke is on a year's leave of absence from the University of Texas, conducting research work at the University of Illinois on the flow of water. He participated as one of the instructors in the recent course in heating and plumbing conducted at the University of Illinois.

Professor Giesecke discussed methods of balancing the friction in gravity flow systems to maintain a uniform flow of water and covered the friction losses in both piping and fittings. As he explained, an extended presentation of the subject which he has prepared is now appearing in THE HEATING AND VENTILATING MAGAZINE.

Following Professor Giesecke's address, there was a spirited discussion.

Massachusetts Chapter

Charles F. Eveleth, chief engineer of Warren Webster & Co., Camden, N. J., was the principal speaker at the April meeting of the Massachusetts Chapter, his subject being "Modulation, Vapor and Vacuum Heating." His talk was illustrated by lantern slides.

President Homer Addams, Secretary F. C. Houghten, W. W. Carrier and Chairman W. H. Driscoll of the society's Committee on Research, were the guests of honor of the Massachusetts Chapter at its March meeting which was held at the Harvard Medical School. Sixty members and guests were present. Dr. Drinker talked on carbon-monoxide poisoning and demonstrated the pulmotor and the Henderson-Haggert inhalator. Philip Drinker spoke on "Electrical Precipitation of Dust, Fumes and Gases," and demonstrated an apparatus which, he stated, gave accurate results in dust determination.

St. Louis Chapter Appoints Code Committee

A special meeting of the St. Louis Chapter called to study the proposed code on heating and ventilating led to the appointment of a special committee to study the various sections of the code. As reported in the chapter's publication, *The Radiator*, "it was pointed out that a number of expressions tentatively included in the code should be eliminated as being injurious. It was suggested that the code would be legally adopted by States and cities and, if so, it might result in serious detriment to the building of high-grade heating and ventilating plants."

Western New York Chapter Entertains University of Kentucky Engineering Students

Thirty members of the senior class in engineering at the University of Kentucky, who were making their annual inspection trip to various manufacturing plants during their Easter vacation, were the guests of the Western New York Chapter, at its April meeting, April 7, at the Lafayette Hotel. Unfortunately, Dean Anderson, who had been expected, was detained in Pittsburgh.

Altogether there were 90 members and guests in attendance at the dinner preceding the meeting. This number was increased by 40 at the time the meeting was called to order, making the gathering the largest in the history of the chapter. President Hutzel announced that plans were under way to raise the required amount of money for the support of the Research Laboratory.

The speaker of the evening was F. E. Rogers, of the Air Reduction Sales Company, New York, whose topic was "Oxygen, the Wonder Worker." Mr. Rogers, who was assisted by L. W. Hughes, conducted a number of interesting experiments with liquid oxygen. In addition, he exhibited four reels of moving pictures, showing how liquid oxygen air is made and why oxygen can be extracted from the air, how acetylene is made and how both gases are used by modern industry to effect the economies in oxy-acetylene welding and cutting. This film was produced by the U. S. Bureau of Mines, in co-operation with the Air Reduction Sales Company.

The second speaker was M. J. Biern, of the American Radiator Company, who talked on "Business Conditions in the Industry." Mr. Biern was optimistic in his views for business during the present year, and backed them up with statistics taken from reliable sources.

An out-of-town guest was J. I. Lyle, treasurer and manager of the Carrier Engineering Corporation, Newark, N. J. and also a Kentuckian, who shared in the welcome extended to the visiting students.

Kansas City Chapter Discusses Research Laboratory Plans

A lively discussion of the new plan under which the Research Laboratory of the A.S.H. & V.E. is working, featured the April meeting of the Kansas City Chapter. Much of the discussion turned on the plan of the Research Laboratory providing for tests, experiments and research by associations, individuals and firms. It was felt by some that the undertaking of research for individuals, firms and trade associations would tend to commercialize the bureau. Others pointed out the fact that all such tests would have to be approved by the Committee on Research and that the results would be published in the *Journal* without comment, and that this publication did not mean the endorsement of the equipment tested or of the results obtained.

A motion was finally offered, providing for the adoption of a resolution that it was the sense of the chapter that "no tests, experiments or research shall be conducted for compensation." This motion, however, was lost.

The plans providing for the raising of $10.00 by each chapter member for the support of the Research Laboratory was taken up and it was decided to postpone further consideration of the plan until after the society's summer meeting in June.

Under the direction of a committee, composed of Messrs. Stackhouse, Wise and Ellis, a motion picture produced by the Laclede-Christy Company, of St. Louis, was shown, devoted to the fire-clay industry.

Society Officers at Meeting of Philadelphia Chapter

Various phases of the society's activities were discussed by visiting officers of the society at the March meeting of the Philadelphia Chapter. In addition to President Homer Addams and Secretary F. C. Houghten, the guests included Treasurer Perry West, and J. Esten Bolling, former chairman of the Guide Publication Committee.

The principal address of the evening was made by F. G. Phegley, of Pittsburgh, whose subject was "Proper Methods of Selecting Boiler Sizes for Different Types of Buildings and Loads." The subject elicited a lively discussion.

It was announced by President R. C. Bolsinger that the April meeting would be devoted to a discussion of the society's proposed heating and ventilating code.

Exhibits at Petroleum Equipment Association

An interesting feature of the annual convention of the American Oil Men's Association in Chicago, March 25-27, 1924, was the Petroleum Equipment exhibition, including as it did, numerous fuel-oil heating products.

Frederick R. Still

Who's Who In Heating and Ventilation

III--Frederick R. Still

IT WAS in the year 1887 when Frederick R. Still got his first introduction to the blower business, with the Huyett & Smith Mfg. Co., at Detroit, Mich. This company began operations in 1881 as a partnership, consisting of M. C. Huyett and W. D. Smith. In 1885, the need of more capital brought about the formation of a corporation with $100,000 capital stock. D. M. Ferry, of seed fame, became president, W. D. Smith vice-president and W. R. Harmount was made secretary and treasurer. Mr. Ferry remained president and Mr. Smith vice-president until 1895, when both sold out, and the name of the corporation was changed to the American Blower Company with a capital of $500,000. Charles P. Hawley succeeded Mr. Harmount as secretary and treasurer in 1887 and in 1890 James Inglis succeeded Mr. Hawley. In 1895 Mr. Inglis became president and Mr. Still has been vice-president or secretary or both since then.

At the time Mr. Still became identified with the business, the company had never attempted to do any heating and ventilating work, and, so far as known, there were only three public buildings in America wherein blowers had as yet been used as a means to produce forced circulation of warmed air, for heating and ventilation. Previous to that time, the business had been confined to the manufacture and sale of cupola blowers, forge blowers, shavings exhaust fans, disc or propeller ventilating fans and dust separators.

GROWTH OF MECHANICAL DRYING SYSTEMS

That year, shortly before Mr. Still became identified with the company, Mr. Smith had been granted patents on a combination of a fan and heater, with an enclosure in which lumber, staves, heading shingles and lath could be dried. That branch of the business grew very rapidly and to such proportions that it quite submerged the importance of the other lines which had been the foundation of the business.

The results attained with this new apparatus showed such an improvement over the old style "bake-oven" or "sweat-box" kilns that it attracted universal attention and the demand soon spread into other lines for drying bricks, tiles, fire-proofing materials, chemicals, drugs, food-products, leather, glue, textiles, etc.

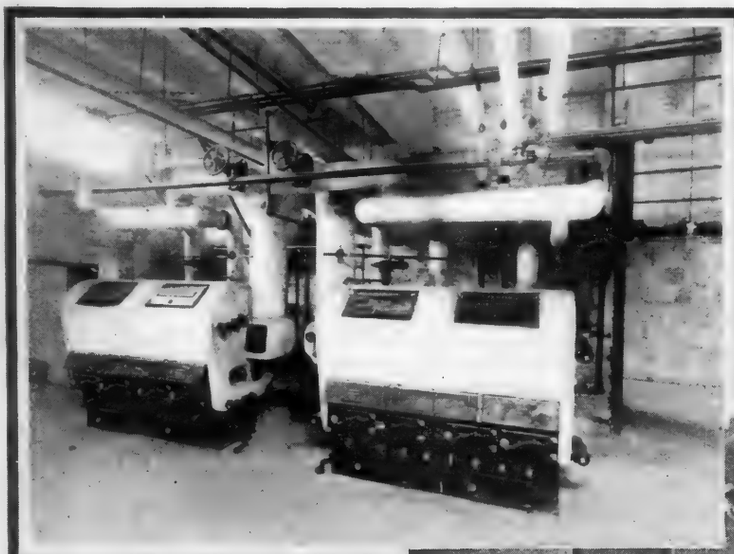
EARLY DEVELOPMENTS IN HEATING AND VENTILATING FAN SYSTEMS

Mr. Smith also conceived the idea, in 1887, that his new blower-heating device would be a fine thing for heating factories, also for heating and ventilating schools, churches, and auditoriums. The company had no difficulty in interesting manufacturers to adopt it for their factories, but it required many years of persistent effort to persuade the school authorities of our cities, and the trustees of churches that it was desirable.

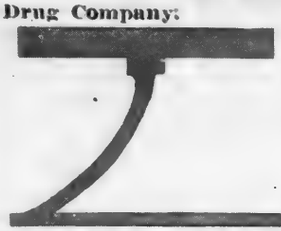
(*Continued on Page* 70)

Engineering Progre

Kansas City Buildings and Their qui Will Be Hosts of the Ame can Ventilating Engineers, at its in Kansas Cit , J

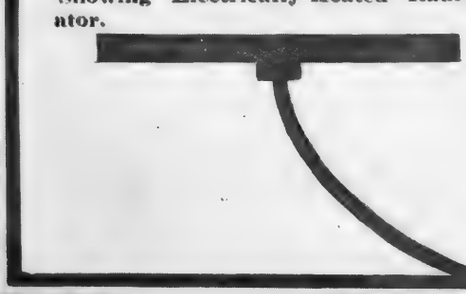


Heating Boilers, Showing Header Connection, Mutual Drug Company.



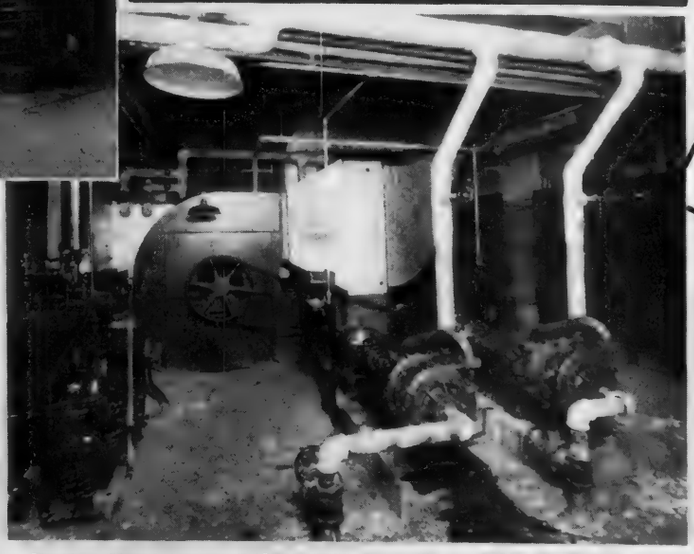
Front Elevation, St. Joseph Ho

Operating Room, St. Luke's Hospital, Showing Electrically-Heated Radiator.

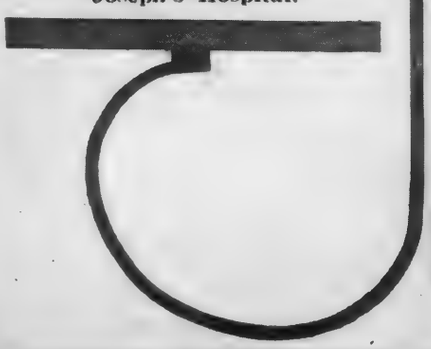


Ventilating Ducts in False eil- ing Cer Corridors, St. Joseph's Hospita

Air Wa her Fan. Re rig- erating Ma- chine. Etc. Land ank Buildin



Oil-Fired Water-Tube Boilers, St. Joseph's Hospital.



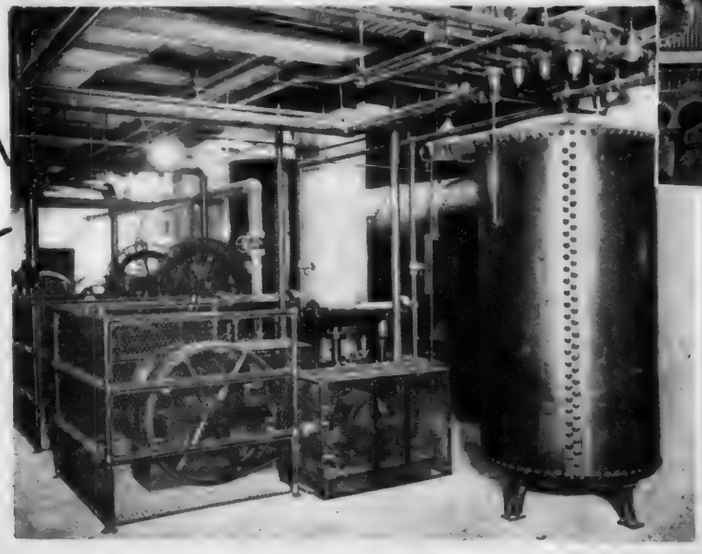
Boiler-Feed Pumps, Vacuum Pumps and Feed-Water Heater St. Joseph's Hospital

ogress Illustrated

quipment Designed by Men Who
can Society of Heating and
ts Semi-Annual Meeting
, June 10-12.

Hospital, Kansas City.

Water, Steam and Brine Piping and Electrical Conduits in Tunnel, St. Joseph's Hospital.

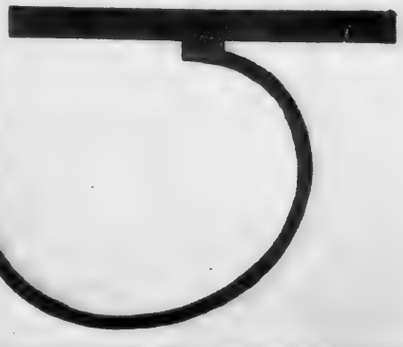


Air Compressors, Pressure Tank and Regulating Valves, Southwestern Bell Telephone Building

Doric Lodge Room, Masonic Te

Showing Supply Grilles Over False Windows and Exhaust Grilles in Step at Floor.

Southwestern Bell Telephone Building, Kansas City.



Who's Who in Heating and Ventilation

Continued from page 67

INSTALLATION REFUSED AS A GIFT

Just as an instance to show the prejudice prevailing at that time, the American Blower Company offered to install a complete plant at its own expense and give it to the city of Detroit, if the School Board would allow the company to put it into one of the new schools, as that the company could have a plant to refer to; but the board would not accept it as a gift.

Later, a plant was donated to an institution for women, but after the offer was accepted, a lot of difficulty was experienced in getting permission from the city authorities to put it in, even though it was accompanied by a bond. That plant was still in operation up to within a few years ago.

DEARTH OF DATA IN EARLY DAYS

Naturally, no one knew very much about the requirements for properly ventilating buildings in those days, so as to make them habitable for human beings. There was nothing in print which could be considered better than somebody's guess, and one guess was just as good as another. This was true regarding every branch of the business, from the firebox of the boiler on through every part of the steam system, the blower, the heater, the ducts, the registers and the very air itself, as concerned its condition when delivered into the rooms.

TESTING INSTRUMENTS HAD TO BE DESIGNED

In those days there were no such instruments as we have today with which to make explorations, and the lack of them made progress much more difficult. The whole field was virgin soil; it was quite as much a part of the business, then, to have to develop instruments to determine what results were being obtained as it was to develop apparatus to attain the results. Nobody then knew what was the relationship between static pressure and air flow. All that was known was that something placed in the path of a column of moving air reduced the flow, but there was no instruments for determining the performance of air in motion, excepting possibly, that erratic and unreliable device known as the anemometer; there were no pressure-measuring instruments, and if there had been, it was not realized that in a column of moving air there are three distinct pressures, which fact had to be developed before pressure-measuring instruments would have been of much value if they had been obtainable.

MECHANICAL VENTILATION WITH STEAM AND WATER RADIATION NOT CONSIDERED IN EARLY BOOKS ON HEATING

The only data then available for determining the carrying capacity of steam and water pipes when atached to radiators were given in the works of W. J. Baldwin and in two volumes put lished by Mills. Neither of these authors had conceived mechanical ventilating apparatus when they published their early editions, hence they had no idea of the relative amount of condensation that could be given off with blower apparatus. Neither did others, until they learned it by bitter experience.

USE OF WOLFF'S HEAT LOSS CONSTANTS

The only data then available for determining the heat losses from buildings, were given in a pamphlet published by Stevens Institute. This was printed from a lecture given by the late A. R. Wolff who had compiled the constants for various materials from some data he had acquired in Germany, the reliability of which he freely admitted was somewhat questionable. These same constants, however, have been re-copied time and again into various publications, and to-day, there is not much difference between what engineers usually rely upon and the original constants as they at first appeared in that pamphlet.

THE PERIOD OF THE MOST RAPID ADVANCES IN THE ART

From 1888 to 1893 more was learned about air, how it is affected by a change of temperature of barometric pressure, by velocity, humidity, etc., and how all those things affect the performance of a fan, than has been learned in a similar period of time since then. It was during this same period that an earnest effort was made to learn how much air is required to attain a reasonable standard of purity in a room, how to determine the degree of purity and how to attain the best distribution. Three men contributed more to this subject at that time than possibly any others; they were Dr. John S. Billings, Professor S. Homer Woodbridge and Professor R. C. Carpenter.

EXPERIMENTAL WORK OF THE FAN MANUFACTURERS

Besides them, the manufacturers of mechanical ventilating apparatus spent thousands of dollars in constantly conducting experiments in an honest effort to establish the fundamental principles underlying all phases of their problems, to whom must be given credit in no small measure for the great achievements that have been made in the science as we know it to-day. Without their foresight, initiative and liberality, healthful ventilation would still remain in about the same status it had been for centuries before.

While many of the things then learned, and which were laid down as indisputable facts, have since been modified or discarded entirely, the pioneering work done by all of them at that time had its effect on future civilization, with a corresponding gain in the comfort and health of humanity.

THE ADVENT OF THE MULTIBLADE FAN

From 1887 to 1907 no material change in the type of fans was noticeable. Some years previous to 1907 a new design was patented in England, but it did not attract much attention in this country until that year. It was a radical departure from what had previously been used. The impeller had about eight times the number of blades. They were very short radially and about eight times as long parallel with the shaft as they were long the other way. They had a deep curvature, with the concave side facing the direction of rotation. The housing enclosing the impeller was only about half the size of the housing previously used, and the speed required to deliver the same volume and produce the same pressure was very much less, even though the impeller was so much smaller than in the fans we were accustomed to.

EFFECT OF THE MULTIBLADE FAN ON VENTILATING PRACTICE

When the rights to make this fan were obtained by the American Blower Company in 1909, the effect on the whole blower business was phenomenal. It completely revolutionized it. Since then, more attention has been paid by all the manufacturers to the development and perfection of blower equipment, instead of trying to delve further into the physical science of ventilation, with the result that every type of mechanism having to do with the movement of air, heating or cooling it, cleaning, humidifying or dehumidifying it, has been improved to a high state of perfection, capable of accomplishing any reasonable results anybody may require and is willing to pay for. It is not exaggerating the truth to say that it is now possible to duplicate indoors the same invigorating and delightful atmospheric conditions we all enjoy outside when in the country on a warm spring day, except to duplicate the sunshine.

PART PLAYED BY A. S. H. & V. E. RESEARCH LABORATORY IN DETERMINING FUNDAMENTALS

Not until the American Society of Heating and Ventilating Engineers established the Research Laboratory at Pittsburgh, has any real research work on the subject of heating and ventilation, along thoroughly comprehensive and practical lines, been attempted in this country. This should not have been a work for engineers to undertake, but they apparently had to do it if it was ever to be done, because the physicists and the medical men seemed to lack either the interest or the initiative or both, to start it.

Like the five-year period from 1888 to 1893, before referred to, the five-year period from 1918 to 1923, since the laboratory was established, has produced more knowledge about the requirements for proper ventilation than had been learned for hundreds of years before.

The first period of five years in the early days taught us how to handle air, the second period, how to use it or to gain the greatest benefits from the use of it. Mr. Still has lived to experience those two periods and in which he has played so large a part, as both periods have accomplished much toward a better civilization, better living conditions, greater comfort and that has, in a way, helped to enrich the world and make it a better place to live in.

National District Heating Association

Program for Annual Meeting

Following is the program for the annual meeting of the National District Heating Association, which will be held in New York, at the Commodore Hotel, June 10-12. The convenient location of this hotel, next door to the Grand Central Station, will make it easy to carry out the entertainment program, as well as being readily accessible for the professional sessions:

MORNING SESSION, TUESDAY, JUNE 10.

Welcome address.
Response.
President's address.
Report of secretary-treasurer.
Report of technical secretary.
Report of Executive Committee.
Appointment of Nominating Committee.
Report of Educational Committee.
Report of Rules and Regulations Committee.

AFTERNOON SESSION, TUESDAY, JUNE 10.

Report of Station Operating Committee, R. D. Wolf, chairman.
Address by Dexter S. Kimball, Sibley College, Cornell University.

MORNING SESSION, WEDNESDAY, JUNE 11.

Report of Heating Research Committee, H. T. Luscomb, chairman.
Paper by William J. Baldwin and F. E. Pendleton, of the New York Steam Corporation.
Report of Heat Utilization Committee. J. E. Seiter, chairman.

AFTERNOON SESSION, WEDNESDAY, JUNE 11.

Report of Operating Statistics Committee, J. C. Butler, chairman.
Report of Hot Water Heating Committee, A. L. Rider, chairman.

MORNING SESSION, THURSDAY, JUNE 12.

Address by A. C. Willard, of the University of Illinois.
Paper by Nelson S. Thompson, chief engineer, Office of Supervising Architect, Washington, D. C.
Report of Distribution Committee, N. W. Calvert, chairman.
Report of Rates Committee, F. A. Tucker, chairman.

AFTERNOON SESSION, THURSDAY, JUNE 12.

Election of officers.
Report of Corrosion Committee, J. H. Walker, chairman.

The association banquet will be held Wednesday evening, June 11, at the Commodore Hotel, and Friday, June 13, will be devoted to an all-day outing for the entire convention party at the Westchester-Biltmore Country Club, at Rye, N. Y., where golf will be the principal order of the day.

Heating and Piping Contractors' National Association

On To Atlantic City

The stage is set for the thirty-fifth annual convention of the Heating and Piping Contractors' National Association, in Atlantic City, N. J., May 26, 27, 28 and 29. Headquarters will be at the Chalfonte-Haddon Hall.

Topics of the day, such as oil-burning apparatus, wages and labor conditions, training of employees, and standardization of materials and methods are listed for discussion. Reports of the activities during the past year of the Board of Directors and the committees of the association will be given and plans for the next year outlined.

Monday evening, the opening day of the convention, is set aside as "Steeplechase Night," when the convention party will gather at Steeplechase Pier, with its many fun-producing machines. The annual dance will be held Tuesday evening.

A new feature of the convention will be the introduction of State group meetings at which a more intimate discussion of local topics can be taken up. These meetings are scheduled for Tuesday morning, so that any recommendations of the groups may be considered at later sessions of the convention.

A conference of secretaries of State and local associations is scheduled for Monday afternoon. This will be devoted largely, as in the past, to an exchange of methods and information concerning labor conditions and the building situation.

Heating and piping contractors, it is announced, who are not members of the association, will be welcome to attend, as the convention is in no sense a closed meeting.

New Officers of New York City Association

New officers of the Heating and Piping Contractors' New York City Association, elected at its annual meeting, March 25, are:

President, George M. Scott; vice-president, William D. Emery, treasurer, William J. Olvany. Board of directors: George M. Scott, William D. Emery, William J. Olvany, Robert J. Currie and George F. Steffany.

Building Records Broken in March

Returns of official building statistics from 213 cities, reported to the *American Contractor*, give the astonishingly large estimated valuation of $419,043,491 for March for 76,477 permits issued. In the same cities last year the total estimated valuation was $397,528,644 for 71,286 permits issued.

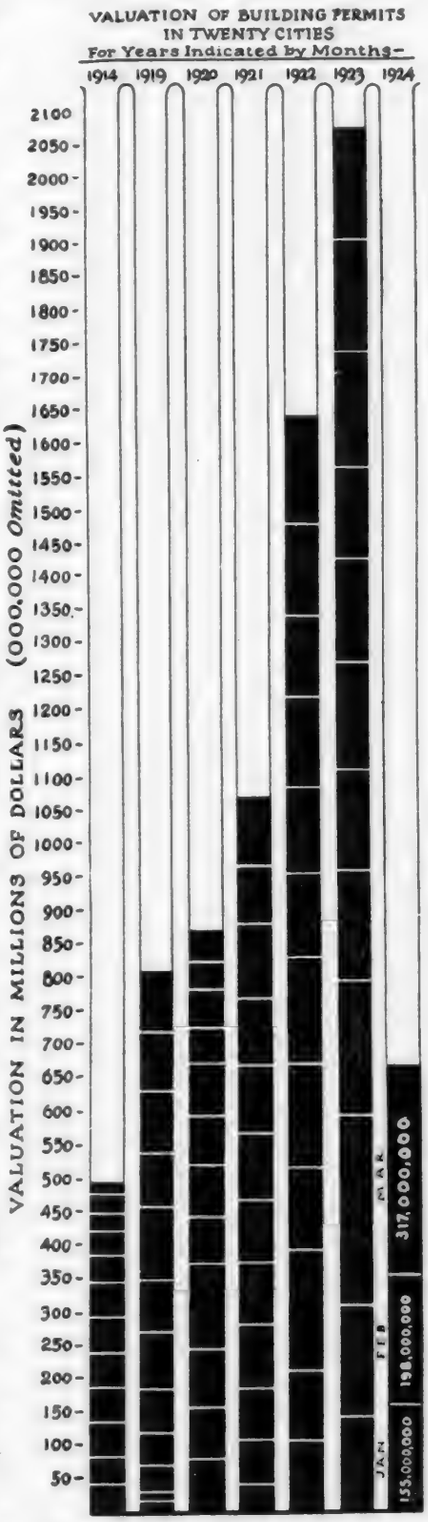


Diagram Showing How March Building Permits Topped the Record

The returns show that the credit for the huge figures, which break all previous records, rests largely with New York City, as no less than 45% of the total valuation of permits was issued in the five boroughs of the metropolis, the exact figures being $188,627,232.

Correspondence

Favors Water Heating Systems for Industrial Plants

EDITOR HEATING AND VENTILATING MAGAZINE:

On Page 63 of your March issue, you have some remarks to make on the subject of water heating systems for industrial plants. This is a subject in which I am deeply interested and one in which I have had more or less experience. The results of this experience are such that I am writing to emphasize the fact that hot water, properly designed and operated, is not only cheaper in operating cost, but in most cases can be made cheaper in first cost than any steam heating system.

This statement may seem incorrect to many of your readers, but it is not, provided the system is properly designed. The reason hot water jobs as a rule cost more than steam jobs is because the designer is not willing to use water temperatures sufficiently high to make the system compare favorably with a steam job.

There is no reason why the temperature of the water on any hot water job in an industrial plant, or anywhere in fact where forced circulation is used, should not run to 220° to 230° F.—the only necessity is that pressure under which this system operates be made great enough to prevent this water from flashing into steam.

In many instances, by designing the system so that the temperature of the water can be made high, in case of an emergency, the cost of the job can be made low, and, as for the larger part of the time, the temperature of the water is low, the operating cost is also maintained low because the low temperature of the water means no necessity for opening windows or doors, and no trouble from uneven heating, either to individuals or any rooms, which is often the case when steam is used, particularly where the ranges of temperature outside may be large.

I have in mind one instance where the system was designed for temperatures for 235°. In three years of operation this temperature has been used but once and the average temperature of the water has been in the neighborhood of 160°; yet the conditions are such that, when necessary, the very high temperature can be used. Had a steam job been installed to handle this building, the operatives would have been very uncomfortable because it was necessary to carry heat a very large part of the time but only at a moderate rate. It was essential that the heating coils be around under the windows near the operatives. With a steam job a part of these operatives would be subjected to steam, whereas the rest of them would have nothing, with the result that part of them would be roasted, the other frozen,—as it is, all of them are comfortable.

This job cost about 15% less as a hot water job than as a steam job, and its operating cost is far less than a steam job.

My recommendation to the hot water designer is to use the maximum temperature he can, but use it only for emergency;—work for an average temperature as low as possible.

HENRY D. JACKSON.

Newton Centre, Mass.

Preventing Water Hammer in Radiators

EDITOR HEATING AND VENTILATING MAGAZINE:

Referring to the letter of Mr. C. Rye, Winnipeg, Man., published in your February issue, your correspondent no doubt could have obtained the same efficiency in draining the water from his radiator by using a union elbow in place of the valve. This would have been easier and less trouble than procuring a copper tube and bending it to fit.

The real principle involved in this case is the matter of having an obstruction in the path of the flowing steam and returning condensate. There is a type of valve on the market which is in effect an elbow with free and unobstructed passage-way, although, of course, this passage-way can be shut off when desired. This is the Gorton quarter-turn packing lock supply valve. It has been found that, with this valve, the friction between the flowing steam and the returning condensate is reduced so much by removing any obstruction in the path of the steam and condensate, such as the disc, steam and raised seat in a globe valve, that it is possible, as a general thing, to use a valve one size smaller than usual.

New York. G. D. C.

Effect on Pipe Sizes in Changing a Heating System from Gravity to Vacuum

EDITOR HEATING AND VENTILATING MAGAZINE:

Kindly advise pressure loss in a 3-in. main, 300 ft. long, supplying 1,000 sq. ft. C.I. radiation, with steam at 20 lbs. absolute pressure.

Also pressure loss in a 3-in. main, 300 ft. long, supplying 1,000 sq. ft. C.I. radiation, with steam at 10 lbs. absolute pressure.

Will you kindly show by example, use of tables on Data Sheet 128 K.

What is your opinion regarding operating a one-pipe steam job under a vacuum in which the mains are undersize. Would not the increase in volume of steam per pound, with this low pressure, aggravate whatever trouble was had with system using steam at approximately 5 lbs. gauge?

Condensation in radiators varies according to the dimensions of the radiator and the temperatures of the steam and of the room. For example, according to tables in the A. S. H. & V. E. Guide, a 2-col., 38-in., 10-section cast-iron radiator in a room at a temperature of 70° F. will transmit 267 B.T.U. at 20 lbs. absolute (5.3 lbs. gauge) pressure and 200 B.T.U. at 10 lbs. absolute pressure (10 in. of vacuum). Multiplying these figures by 1,000 sq. ft. of radiation and dividing the product by the latent heat of the steam at each pressure gives 272 lbs. of condensation hourly, in the first case, and 208 lbs. in the second. However, for most purposes 300 lbs. (5 lbs. per minute) would be the figure used, as this allows for heat losses in the distributing mains.

Referring to the curves on Data Sheet 128L (referred to as Fig. 1 on Data Sheet 128K), read down second left-hand column "Lbs. per min." under heading "For 2-in. pipe and larger" to 5 lbs., then right to intersection with 3-in. pipe and then down to "Drop in lbs. per 100 ft.," which, in this case, will be found about 0.06 lbs. (1 oz. per 100 ft.), or 3 oz. for 300 ft. The curves are a little close together to read for the slight steam delivery and small size of pipe in the question submitted, so that the stated drop was checked by Unwin's formula for flow of steam.

The conditions in the second query are questionable, as the vacuum does not extend to the inside of the radiators. However, answering the question, multiply the drop in pressure (3 oz.) obtained at 20 lbs. absolute pressure by the factor (1.91) in Table 2 (Data Sheet No. 128-K) for 10 lbs. absolute pressure. The pressure drop is then 5.73 oz. per 300 ft.

This answers the first two questions and at the same time shows the use of the tables as further requested. Examples of such use are also given on Data Sheet 128-K. The latter, of course, is for use with Data Sheet 128-L. Table 1 on Data Sheet 128-K was originally published along with pertinent data in Proceedings, A. S. H. & V. E., 1907. The curves on Data Sheet 128-L were derived from this table and data, so that the table serves no other purpose. A one-pipe job cannot serve as a vacuum system until converted into a two-pipe job. As the pipes are larger in a one-pipe job, they should be of ample size in a vacuum system. However, supply-pipe sizes should not matter because the specific volume of the steam in the supply main does not change, the same supply pressure is used as before. Only the returns are under vacuum, nevertheless, no change in return pipe sizes should be required. Gravity dry returns would be of sufficient size, though gravity wet returns would probably be too small for use in a vacuum system.

The volume of steam at 10 lbs. absolute pressure is about twice that at

reduce the steam pressure in the supply main from 20 to 10 lbs., the velocity of the steam would be two times, and the drop in pressure four times, as great for the same heat delivery, drop in pressure varying as the square of the velocity. On the other hand, at the lower pressure there is a slight gain in the latent heat of a pound of steam, though the gain is not commensurate with increase in volume. Again, the positive return of air and condensation obtained by means of a pump together with lift fittings at necessary points insures a quick and effective circulation in the vacuum system, in particular as compared with the ordinary gravity system where the air must be compressed and driven through the pin holes of radiator air valves. This should offset any disadvantage resulting from insufficient pipe sizes. However, as previously stated, the steam being in the supply mains and its pressure, therefore volume, not changing, it is difficult to see how the proposed change could be detrimental in the matter of pipe sizes.

Possibly the correspondent refers to vapor systems, instead of vacuum systems. In this case the vacuum does extend throughout the radiators and supply pipes, as well as the return pipes This being so, whenever the outside temperature is above zero, the system can be operated so as to heat the building economically with steam pressures lower than 20 lbs. absolute, the heat transmission, as far as possible, being made to conform with the reduced heat loss.

Comparing the volume of steam required at various pressures by means of their specific volumes is misleading. A pound of steam at the lower pressures will occupy more space, but this is in part offset by the gain in latent heat and the fact that fewer pounds of steam are required as the heating requirements are less. For example, in the problem under consideration, from 20 lbs. down to 10 lbs. the specific volume increases 92%, but the total volume increases only 43%, thus 278 lbs. $\times$ 20.08 = 5,582 cu. ft. and 208 $\times$ 38.38 = 7,983 cu. ft.

It may be of interest to note that the heat transmission with 10 lbs. absolute pressure will correspond to the heat required when the outside temperature is 17° F., determined as follows:

Assuming 1,000 sq. ft. of radiation installed to heat the building at an outside temperature of zero, the maximum heat requirements will be (267 $\times$ 1,000) = 267,000 B.T.U. At 10 lbs. pressure the heat transmission will only be (200 $\times$ 1,000 = 200,000 B.T.U.) 75% of this amount. This would correspond to the heat loss at a temperature difference of (75% of 70°) = 53°, or an outside temperature of (70° — 53°) = 17°.

At outside temperatures above 17°, the radiation will give off more heat than required, unless the steam pressure is lowered below 10 lbs. absolute. If this is the minimum pressure, at temperatures above 17° any pipes of insufficient size would be of advantage in reducing the heat delivered to the radiators. Closing off excess radiation would reduce the total volume of steam in the mains. Thus, at 10 lbs. pressure and an outside temperature of 33° F. the heat demand (139,600 B.T.U.) would require only 5,582 cu. ft. of steam, the same volume as required at 20 lbs. pressure, and the radiation required would only be [(5,582 $\times$ 960 $\div$ 38.38) $\div$ 200] = 698 sq. ft. In this connection the following table has been prepared to show the conditions above or below the temperature of 33°.

Outside Temperature Deg. F.	Absolute Pressure Pounds.	Total Volume Cu. Ft.	Radiation Required, Sq. Ft.
0 to 17	20 to 10	5582 to 7983	1000
17 to 33	10	7983 to 5582	1000 to 698
33 up	10	5582 down	698 down

T. W. R.

The Sylphon Type of Air Valve

EDITOR HEATING AND VENTILATING MAGAZINE:

The writer has enjoyed reading the article on "Air Valves" in THE HEATING AND VENTILATING MAGAZINE.

We note that this article is to be continued and we are trusting that it will cover the principle of the sylphon air valve.

New York.

C. S. H.

As pointed out in the article "Back to First Principles" in THE HEATING AND VENTILATING MAGAZINE for January, it is impossible to describe all makes of air valves in a series of articles arranged so as to cover eventually a large part of the devices and methods used in the heating and ventilating field.

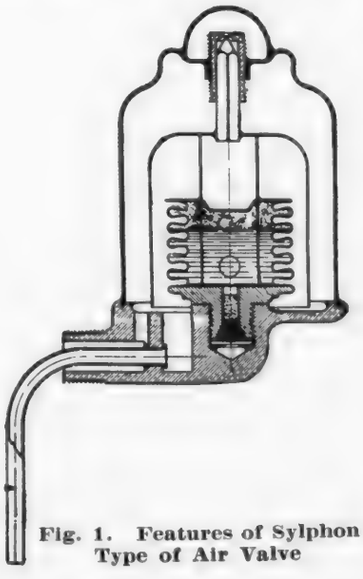


Fig. 1. Features of Sylphon Type of Air Valve

However, we are glad to give some attention as correspondence to a valve of this type (Fig. 1), as it embraces in its construction certain distinctive features. The sensitiveness of any expansion member increases with the number of diaphragms or folds. It may also be pointed out that the side vent hole at the top of the air valve is especially desirable during erection of the building in preventing mortar and dirt from clogging up the interior valve discharge opening. The large discharge port also has its advantages. Other features of this valve are shown in the illustration.

T. W. R.

Death of Elias D. Smith

ELIAS D. SMITH, perhaps best known in his later years as commander of the "old guard" of the Heating and Piping Contractors' National Association, died at his home in Elizabeth, N. J., April 1. The cause of his death was pneumonia, from which he had been ill four days. Had he lived until April 15, Mr. Smith would have celebrated the 84th anniversary of his birth.

Mr. Smith was for years a prominent figure in the heating contracting industry. He was formerly a member of the firm of Baker, Smith & Co., New York, one of the largest heating contracting concerns in the country, and was prominently identified with the development of the industry from 1884 until the time of his withdrawal from business a few years ago.

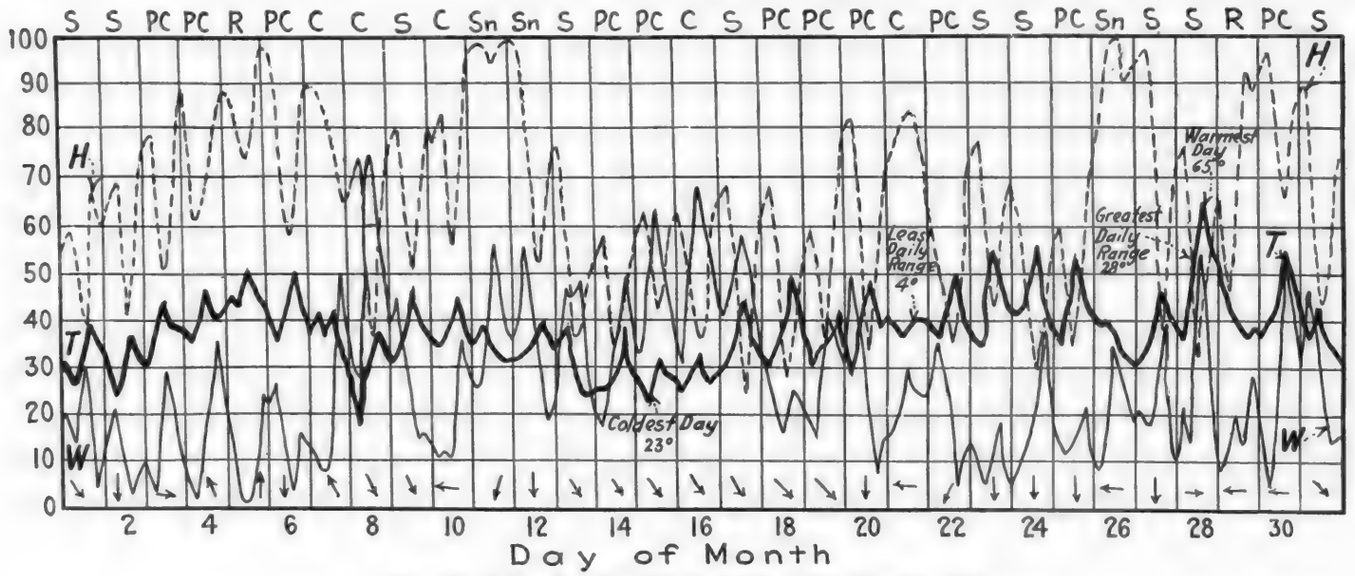
He had served as a director, treasurer, vice-president and president of the Heating and Piping Contractors' New York Association. In 1897 he was elected president of the Heating and Piping Contractors' National Association. At most, if not all of the conventions held since that time, he has been a constant and enthusiastic attendant and the closing sessions were often enlivened by his wit and half-humorous, yet sound, advice, with which as temporary chairman, he was wont to install the newly-elected officers. His death marks the passing of almost the last of that important group of men who played so large a part in shaping the industry in its pioneer days.

Death of President Walter J. Francis of the Engineering Institute of Canada

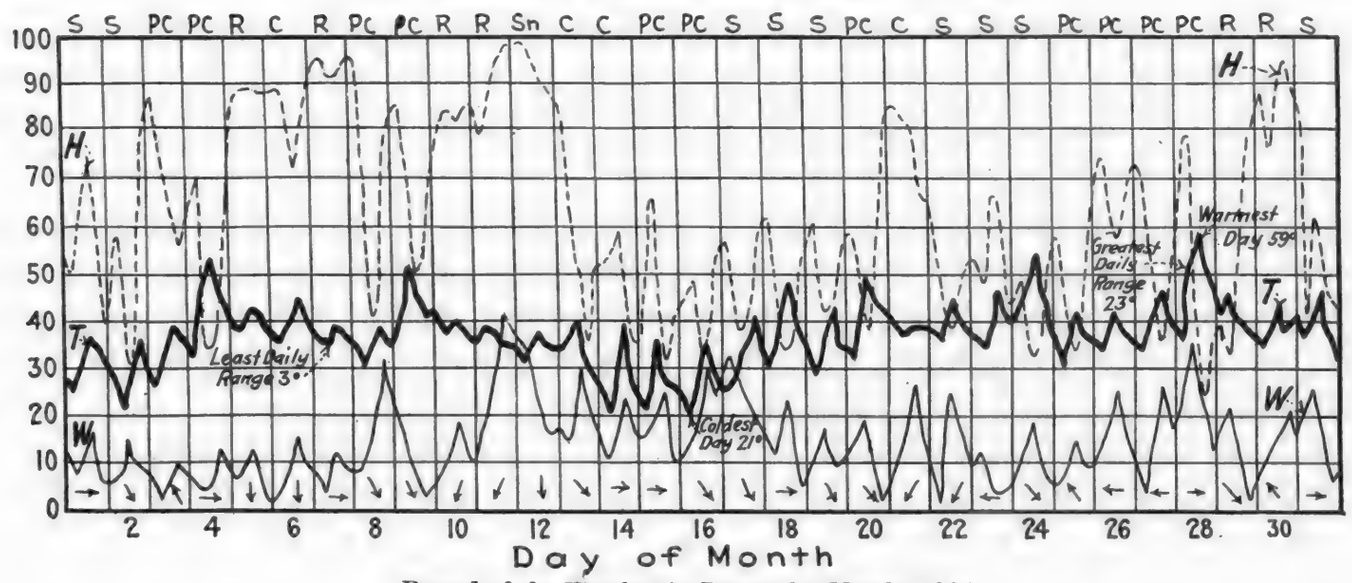
By a strange coincidence the president of the Engineering Institute of Canada, Walter J. Francis, has died in office, as did his immediate predecessor and on the exact anniversary of the death of the former president, Arthur St. Laurent. Although two weeks and a half previously he had been confined to the house with throat trouble, and, later, for a week, due to a slight indisposition, for three days previous to his death, he had been at his office, where he displayed his usual energy towards his work. His death occurred on March 6.

The Weather for March, 1924

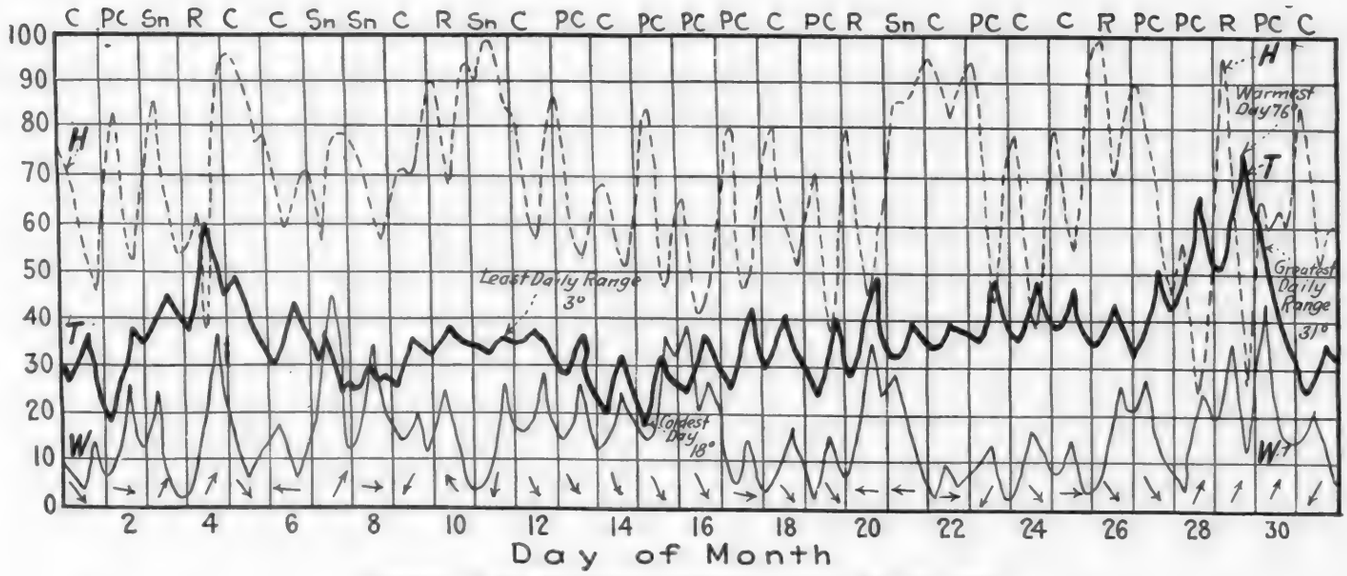
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F	65	59	76	63	72
Date of highest temperature	28	28	29	27	27
Lowest temperature, deg. F	23	21	18	17	21
Date of lowest temperature	15	16	15	7	10
Greatest daily range, deg. F	28	23	31	26	29
Date of greatest daily range	28	28	30	27	27
Least daily range, deg. F	4	3	3	3	3
Date of least daily range	21	7	11	17	23
Mean temperature for month, deg. F	38.7	37.4	37.0	34.6	39.88
Normal mean temp. for month, deg. F	37.7	35.6	39.6	36.3	43.8
Total precipation, in	1.65	2.04	4.15	3.7	3.24
Total snowfall, in	3.0	7.4	17.8	11.9	15.88
Normal precipitation, this month, in	4.1	4.08	3.01	2.55	3.43
Total wind movement, this month, miles	16502	9074	9711	8733	10270
Average velocity, miles per hour	22.2	12.2	13.1	11.7	13.8
Prevailing direction of wind	N. W.	W	N. W.	N	N. W.
Number of clear days	9	11	0	4	4
Number of partly cloudy days	11	11	14	6	9
Number of cloudy days	11	8	17	21	18
Number of days with precipitation	8	7	14	15	12
Number of days with snow	3	3	7	10	6
Snow on ground at end of month	None	None	None	0.1	0.1



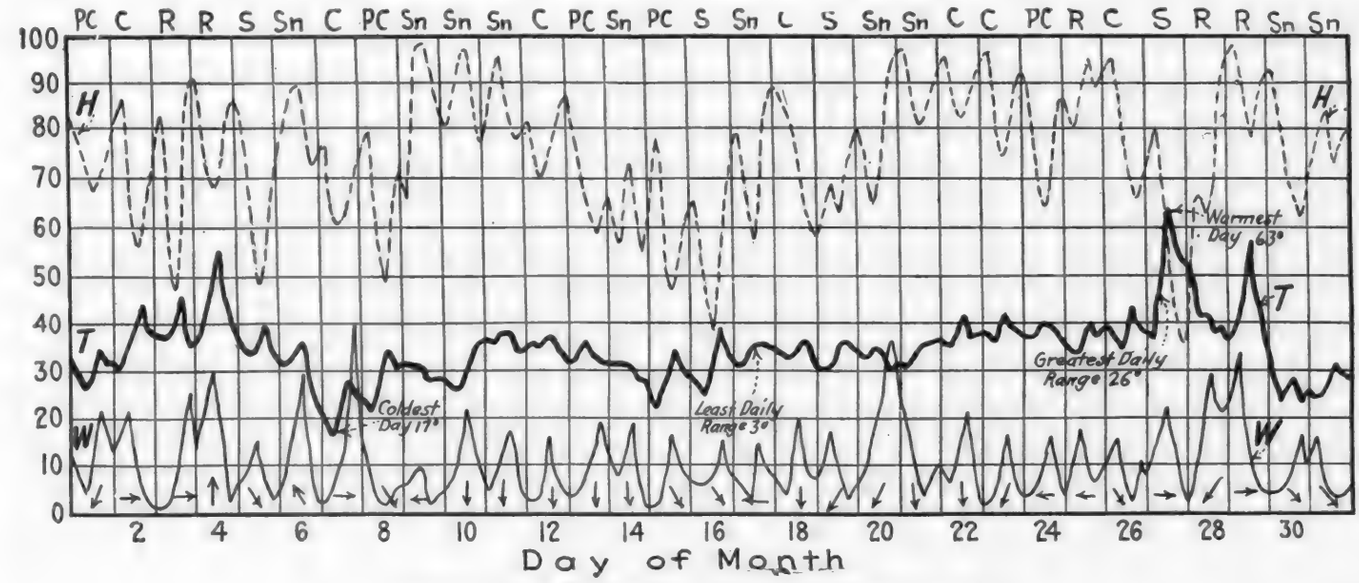
Record of the Weather in New York for March, 1924
(Hourly Observations of the Relative Humidity Plotted on this Chart)



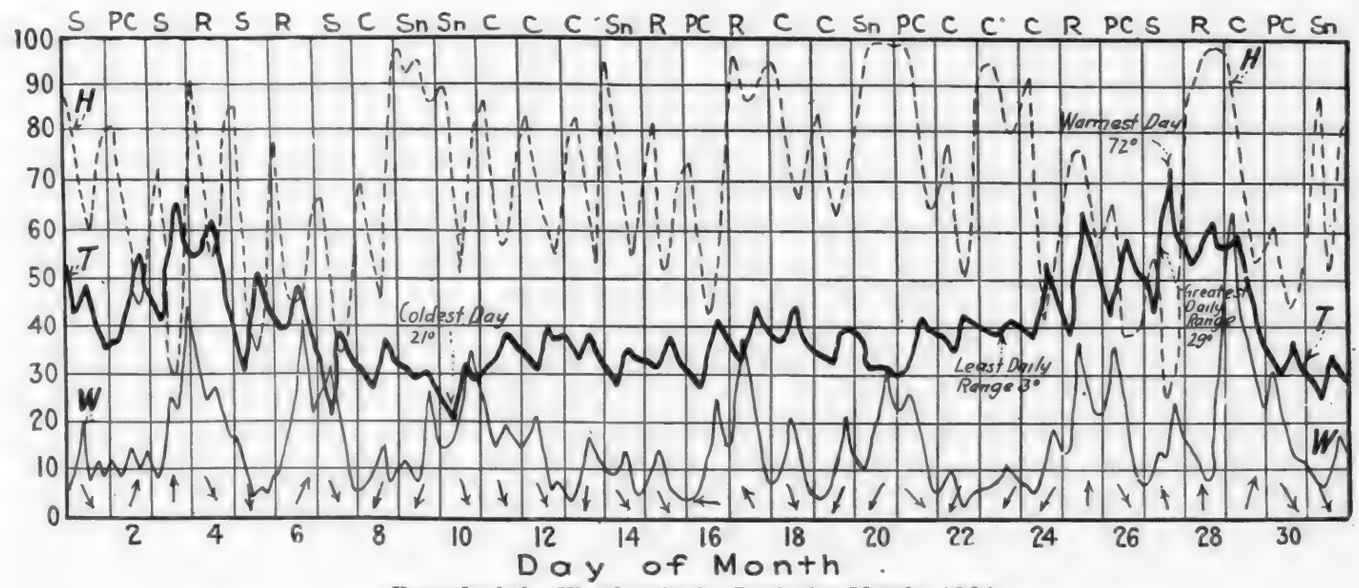
Record of the Weather in Boston for March, 1924



Record of the Weather in Pittsburgh for March, 1924



Record of the Weather in Chicago for March, 1924.



Record of the Weather in St. Louis for March, 1924

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A. M., 12 M., and 8 P. M.
S—Clear, PC—partly cloudy, C—Cloudy, R—rain, Sn—snow. Arrows fly with prevailing directions of wind.

New Apparatus and Appliances

New Spray Nozzle Design for Use in Air Washers

Details now available of the spray nozzles for the new Clarage Type V air washer, recently placed upon the market by the Clarage Fan Co., Kalamazoo, Mich., show their ingenious design. The nozzle consists essentially of three parts: a female half, which is attached to the water supply, a deflecting disc, and a male half which acts as the atomizer. The water entering the chamber of the female half, impinges against the disc and is forced radially outward. The disc in the female half rests on three supporting ribs which are machined and which hold the disc central. The water now leaving the female half passes into an outer annular chamber of the male half. Two tangential openings, opposite each other, connect this annular chamber with a central circular chamber just back of the orifice. The shape and location of the two openings produce a whirling motion of the water within the central chamber. Thus, the water leaving the orifice, it is stated, is diffused into an extremely fine spray of large diameter, providing an unbroken mist screen. The spray has been found to measure 15 in. in diameter at a distance of 7½ in. from the tip of the orifice.

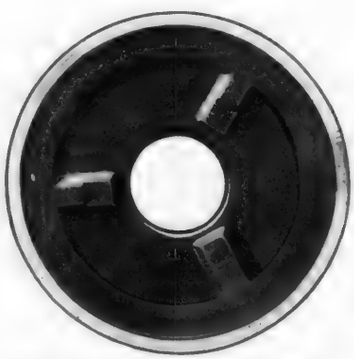
Both the passages and the nozzle openings have been made large to avoid clogging. The opening at the inlet end of the nozzle is ⅜-in. in diameter, the passages, it is figured, are of sufficient size for all conditions, and the spray orifice is 3/16-in. in diameter. Passages leading into the orifice chamber are the smallest openings through which the water must pass, and they are four times greater than the mesh of the screen through which the water is drawn before reaching the pump. Each nozzle has a capacity of 2 gals. per minute under a pressure of 20 lbs., which is the usual pump pressure. The nozzles are spaced evenly over the washer in the ratio of at least three nozzles per 1000 cu. ft. of air per minute.

In addition to the spray nozzle equipment, as described, these air washers are also made with flooding nozzles which are installed at the top of the scrubbing plates, to keep a constant film of water descending over the entire length of plates and carrying with it the impurities which these plates collect. The flooding nozzles are furnished as extra equipment and are used primarily for summer cooling purposes in installations where the washing of the air is not necessary.

Deflecting Disc against which water impinges.

Side View of Assembled Nozzle.

Interior View of Female Half of Nozzle.

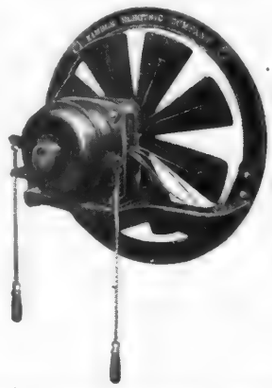


Interior View of Male Half of Nozzle.

Design and Construction of Spray Nozzles for Clarage Type V Air Washer

New Ventilating Fan

A variable-speed, reversible, ventilating fan for alternating-current service, has been placed on the market by the Kimble Electric Co., 634 N. Western Ave., Chicago. The manufacturers announce that a specially-designed repulsion-type motor of high efficiency is used and the speed is regulated by shifting the brushes on the commutator of the motor, by means of two pendant chains attached to the rocker arm. These same chains also reverse the fan. The construction permits of controlling the fan through resistance when remote control is essential.



Kimble Variable-Speed, Reversible Exhaust Fan

The variable-speed feature, it is stated, makes the fan desirable for the ventilation of restaurants, theatres, hotels, club houses, factories, etc., because the volume of air moved can be adjusted to meet varying conditions. Adjustment of the chains converts the fan from an intake to an exhaust fan, or vice versa.

New Dial Thermometer for Industrial Use

A departure in thermometer construction is announced by the Moto Meter Co., Inc., Long Island City, N. Y., in the development of the Motoco industrial thermometer. This instrument is of the dial type, thus retaining the advantages of easy reading offered by indicating thermometers of that class. The dial is of the standard ammeter form, with large, legible numerals, which can be read at an average distance of 20 ft. For installations in dark or inaccessible places, 10 ft. of tubing is furnished as part of the regular equipment. By inserting the bulb at the point where it is desired to take the temperatures, the head may be mounted in the light on the wall, instrument board or elsewhere, thus facilitating temperature readings. It is also possible to extend the tubing greater distances by using an extra length of tubing.

The manufacturers announce that by reason of simplified construction the Motoco thermometer can be placed on a competitive price basis with high-grade armored glass thermometers. In this

instrument the pointer is connected direct to the Bourdon coil, making a "one-to-one" movement, eliminating the usual intermediate rack and pinion movement, and thereby doing away with screws, levers, hairsprings, gears, and other delicate parts. The arbor on which the pointer is mounted rotates on a bearing and is the only movable part. The pointer is riveted instead of being screwed to the arbor.

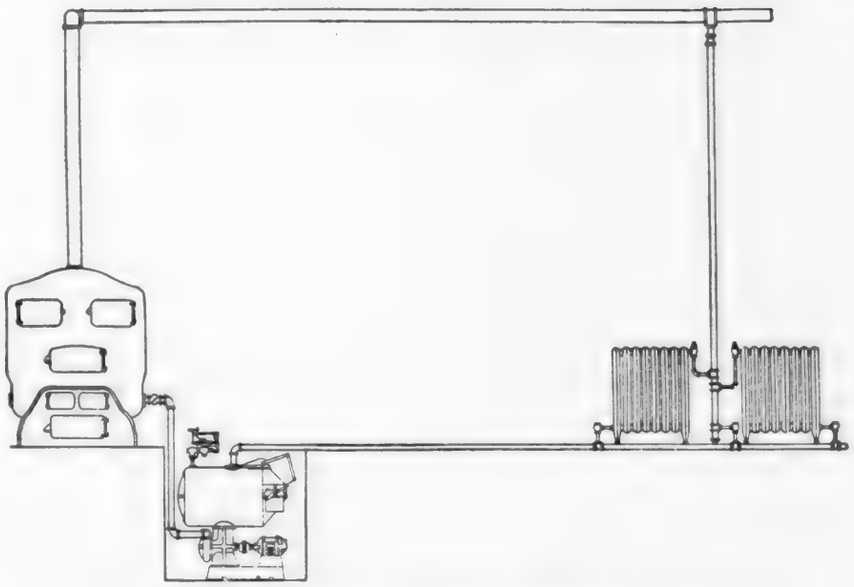
The Bourdon coil, together with the capillary tube and its sensitive bulb, are filled with specially-treated alcohol under pressure. When the bulb is subjected to heat or cold the alcohol column expands or contracts, causing the coil to wind or unwind, and, in so doing, to move the pointer across the dial. A distinctive feature of the Motoco thermometer is the form of the capillary tubing, known as Schlaich's star-shaped tubing. By running the tubing through V-shaped rollers, the walls are pushed inwardly, forming a tube of star-shaped section, with a diameter between 6/1000 and 7/1000 of an inch, or one-third the size of the orifice in ordinary tubing. Another feature of the Motoco thermometer, pointed out by the manufacturer, is the unusually small bulb, averaging 2 in. in length and ¼ in. in diameter, which permits of connection with a 1-in. pipe. Non-ferrous materials are used throughout, the case and bracket being of aluminum. In addition to the standard equipment, the Motoco thermometer can also be fitted with electric contacts for bell ringing. The instrument is made in two sizes, one having eleven dial ranges and the other, nine. Both have the same temperature latitude, from 40° F. to 500° F.

The construction follows the same principles as the airplane moto-meters manufactured by this company during the war, and use is made of the same materials as approved by the U. S. Bureau of Standards. Over 20,000 instruments of this type were used during the war on army and navy planes, including the famous NC Transatlantic flyers.

An Automatic Hydraulic Vacuum Producer

An interesting device for creating and maintaining a vacuum in any type of steam-heating system has been brought out by the A. & P. Regulator Co., Park Ridge, Ill., under the name of the A. & P. automatic hydraulic vacuum producer. The device is intended to be operated by city water. It is arranged to operate automatically. When used on heating work, it is designed to completely shut off the water supply automatically when 3 to 5 in. of vacuum is established, and to operate again when the vacuum in the system drops to a low point. Approximately 3 gal. of water per minute is consumed when the vacuum producer is operating, but, it is stated, only a few minutes are required for securing the desired vacuum in the ordinary system.

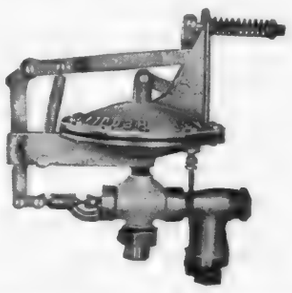
The advantage of such an arrangement is realized when it is considered that in the ordinary system, without a vacuum, it is necessary at all times to create enough pressure in the boiler to drive or force out the air.



A. & P. Automatic Vacuum Producer Applied to Return-Line Heating System

The accompanying illustration of a return-line heating system shows the location of the vacuum producer connected to the top of the receiver, to maintain a vacuum on the system, while the pumping unit delivers condensation to the boiler. In this system each heating unit is equipped with a thermostatic trap. This vacuum producer, it is stated, can also be operated in connection with direct-return steam traps by making connection from exhaust of trap to the vacuum producer.

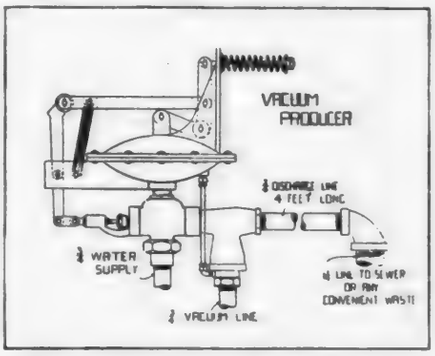
Normally the vacuum producer is in an open position. As soon as water is turned on, it rushes through into the discharge line to the sewer or waste, but in doing so, it creates a vacuum below the check, or on the vacuum line. This vacuum also extends



Construction of A. & P. Automatic Vacuum Producer

up through the small tube and acts on the lower part of the diaphragm.

As the vacuum builds up, it pulls the plunger down, causing the angle lever to work against the back spring set for the desired vacuum. It likewise moves the upper arm, which is held down with a spring, until the roller at the end passes over the pointed lever connected to the water-supply valve, causing this valve to snap shut. As the vacuum in the system diminishes, the back spring acts to pull the levers in the opposite direction, carrying the roller back over the point, instantly opening the water-supply valve, which causes the producer



Installation Diagram for A. & P. Automatic Vacuum Producer

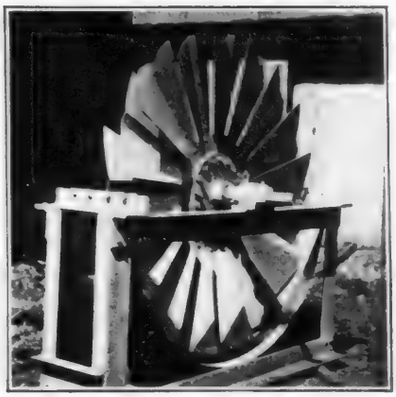
to again pull a vacuum. A point emphasized by the manufacturer is that the vacuum in the system cannot be broken through the open discharge line to the sewer or waste while the water supply valve on the vacuum producer is shut off.

The device is made in a single size, ¾ in. with a maximum capacity with 20-lb. water pressure of 2500 sq. ft., and with a 40-lb. water pressure, of 3500 sq. ft. For large installations two or more units are used. It is listed at $100.00.

New Type of Multiblade Disk Fan.

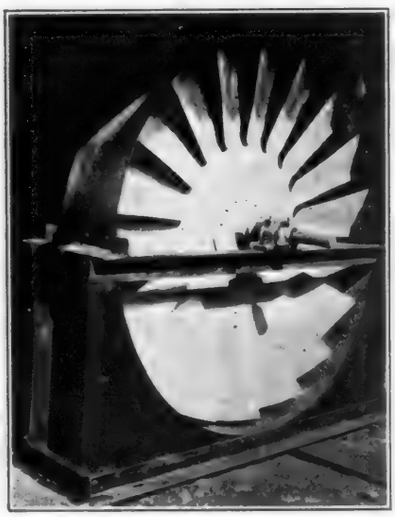
A multiblade disk fan, designed by R. W. Oswald, of Pittsburgh, Pa., primarily for use in mine ventilation, has been found to move such large volumes of air against high water gauges at a reduced number of R.P.M. that its inventor is suggesting its use in heating and ventilating work.

The wheel, shown in the accompanying



Construction of New Multiblade Disc Fan

illustration, is made of two heavy steel disks, bent, placed back to back and riveted. The blades are full, overlapping their entire length and, it is stated, provide a maximum



Complete Multiblade Disc Fan Unit

blade area. The bearings are collar oiling or may be had with Hyatt roller bearings. These units are being made in their present form by the Pittsburgh Fan & Mfg. Co., Pittsburgh, Pa.

Large Copper Boiler Installation

An unusually large copper boiler installation is reported by the Dahlquist Mfg. Co., 40 West 3rd St., Boston, Mass., in the new Chamber of Commerce Building, in Boston. The accompanying illustration shows one of the three copper boilers installed in this building, each of which has a capacity of 1000 gal.

The Molby Boiler at the New York Coal Economy Show

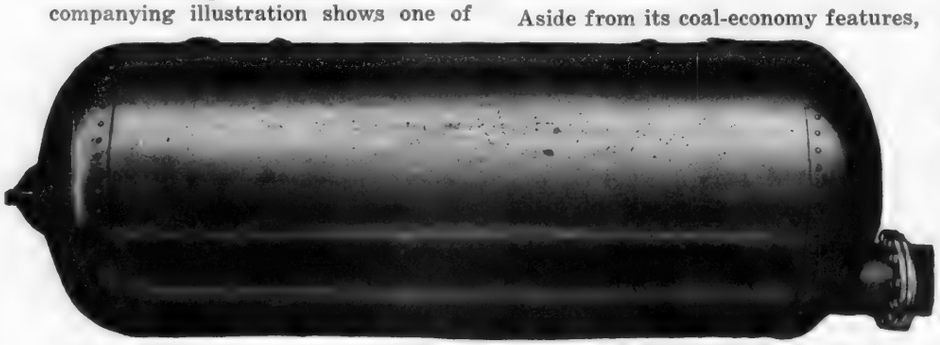
Among the boiler exhibits at the recent Coal Economy Show, in New York, that of the Molby Boiler Company, New York, which included the Molby down-draft boiler, which is designed to burn No. 1 buckwheat anthracite, was particularly appropos, as the show was intended to show the advantages of burning these smaller coal sizes. For one thing buckwheat coal is about $7.00 a ton cheaper than the sizes of anthracite used in most house heaters and, in the second place, there is an abundance of it.

The "New Molby," as the latest types are designated, are built on the down-draft and cross-draft principle, and are designed especially to prevent the waste of smoke and gases. With this construction, states the manufacturer, it is possible to consume every combustible part of the coal.

Aside from its coal-economy features, the boiler is featured as a saver of time, labor and attention in operation. Magazines are provided to carry a 12-hour supply of No. 1 buckwheat. The construction of the magazine permits the coal to be fed slowly and continuously to the fire. For this reason, as no night attendance is required, the boilers are described as being particularly useful in apartment houses, garages, greenhouses or other large places requiring heat at night. In the home, of course, the self-feeding feature is a relief to whoever has to attend the boiler during the day.

Sizes of this boiler are available with steam ratings ranging from 500 sq. ft. to 7,750 sq. ft. and for water ratings from 850 sq. ft. to 12,925 sq. ft.

Molby Boiler Company's Exhibit at New York Coal Economy Show



One of Three Large Copper Tanks for New Chamber of Commerce Building, Boston

New Method of Lavatory Ventilation

A method of ventilating lavatories in which the exhausting is done directly from the fixture itself has been developed by the Buffalo Forge Company. By this method, it is stated, the gases are exhausted at the source and before they have become distributed over the room. Because of the direct and positive suction afforded, there has resulted a rapid and efficient method of ventilation. In addition and principally because of the reduced air requirements, it has been possible to use a much smaller fan unit. An example of the method advocated is given in the accompanying illustration.

As will be noted, the arrangement consists of a fractional horse-power motor direct-connected to a Type RE exhauster. These units are equipped with cord and plug, ready for connecting to the lighting circuit. The placement of the fan may be one of several

ways. The easiest, of course, is to place the fan and motor on a small bracket attached to the wall at some point most convenient.

In large public and semi-public buildings it is customary to place the entire unit, including the piping, inside the wall partitions or in some area or passage-way. A main suction line leads from the fan inlet. From this duct a smaller air line, perhaps 2½ in. in diameter, leads to each individual fixture. Where direct connections are made, a special fixture is required. With the older type of fixture, the air suction pipe can be connected to the water feed pipe by means of a T section.

Meeting the Rapidly-Growing Demand for A Small Steel Heating Boiler

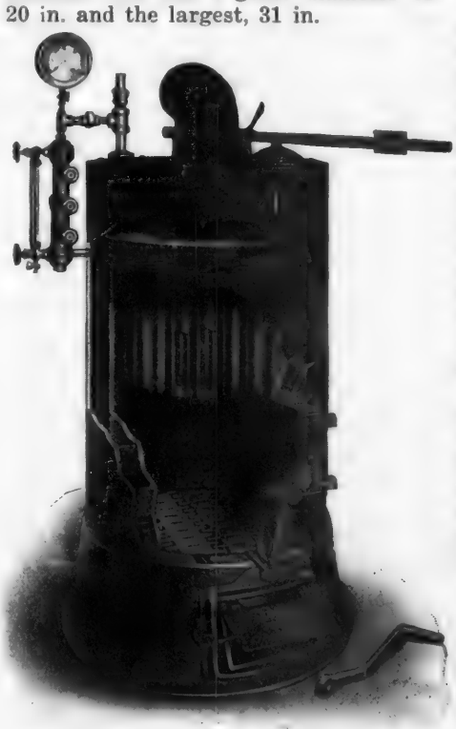
A Small All-Steel Heating Boiler

A boiler made entirely of solid steel plate, with a uniform thickness of metal throughout, has been placed on the market by the Herbert Boiler Co., Chicago, Ill. It is known as the Herbert Junior boiler. There are no riveted seams in its construction, all the joints being welded.

Its design, it is stated, provides the largest amount of direct heating surface above the smallest grate of any boiler built. Care has been taken to avoid the use of flues or soot-holding ledges, so that every part of the boiler is self-cleaning, due largely to the fact that all the surfaces below the crown are vertical.

The water, it will be noticed from the illustration, is divided into narrow bodies proportionately distributed above the fire and completely water-jacketing the combustion chamber.

The additional fact that the boiler is all in one piece is mentioned as an advantage in saving labor while erecting. Three sizes are provided ranging from 375 sq. ft. steam radiation or 625 water radiation, to 750 sq. ft. steam radiation, or 1,250 sq. ft. water radiation. The smallest size has a grate diameter of 20 in. and the largest, 31 in.



Herbert Junior All-Steel Boiler

New Small Steel Boilers for Low-Pressure Work

An interesting development in the form of small steel heating boilers, to meet a rapidly-growing demand, is announced by the Fitzgibbons Boiler Co., 47 West 42nd St., New York. The new

Fitzgibbons Ontario Steel Boiler for Low-Pressure Heating

product is known as the Fitzgibbons Ontario boilers.

In the rebuilding, re-equipping and modernizing of its boiler works at Oswego, the Fitzgibbons Boiler Company has given special consideration to the production of these small heating units so as to bring the small steel boiler commercially within the reach of the average user. As will be seen from the accompanying illustration, the new heaters have the same general appearance as the Fitzgibbons boiler. They are manufactured in a full series, ranging from 600 sq. ft. to 1800 sq. ft. for steam and from 1000 sq. ft. to 2900 sq. ft. for water. They are being marketed as essentially quality boilers.

The Fitzgibbons Boiler Company announces the appointment of Frank T. Chapman, as general sales manager. Mr. Chapman has long been a prominent figure in the heating and ventilating field. He was for many years manager of the Vento Department of the American Radiator Company.

HOW TO CUT DOWN THE COST OF HEATING YOUR HOME is the title of a folder published and distributed by the Anthracite Bureau of Information. The booklet explains how to burn the smaller grades of coal and urges more attention to damper controls.

Savings through Temperature Control in a Minnesota Building

A striking instance of the savings which are possible through the application of temperature-control devices is reported in the case of the Essex Building, St. Paul, Minn. The facts are told in an interesting way in a letter from the operators of the building, Messrs. Davis & Lagerman, to the Minneapolis Heat Regulator Company, whose devices are used in the building:

"The Essex Building" they write, "was formerly heated at so much a radiator but in the Fall of 1917 we contracted with the Northern States Power Company to supply the building with steam on a meter basis.

"We attempted to regulate the supply by operating the main valve but this, as you know, is not good practice, for a throttled valve will condense part of the steam as it passes through, and also the building is either too hot or too cold. In the Spring of 1921 therefore, we instructed Prendergast Bros., heating contractors of St. Paul, to install your regulator and balanced valve.

"The valve and regulator proved a big success in many ways, the principal one being the large saving effected."

It seems that one of the tenants was a piano manufacturer who had complained that the shutting off of the steam overnight or on Sundays resulted in such low temperatures as to contract the strings of his pianos sufficiently to put them out of tune. Since the installation of this regulator no further complaints have been received from this source.

"In regard to the actual savings we made," continues the statement, "the following figures will be of interest:

"December 1921—17% saving over Dec. 1918 and 1919.

"December 1922—17% saving over Dec. 1918 and 1919.

"January 1922—12% saving over Jan. 1919 and 1920.

"January 1923—13% saving over Jan. 1919 and 1920.

"February 1922—16% saving over Feb. 1919 and 1920.

"February 1923—15% saving over Feb. 1919 and 1920.

"March 1922—27% saving over Mch. 1919 and 1920.

"March 1923—31% saving over Mch. 1919 and 1920.

"We arrived at the percentage of saving by first reducing or raising the steam consumption during any one month to a 30-day basis. Then we compared this result with that of a similar month of another year, taking into account the difference between the mean temperatures of these months as recorded by the U. S. Weather Bureau.

"For example, suppose our steam consumption in January, 1919, with the valve operated by hand, was 207,000 lbs. for a period of 32 days, as billed by the heating company. The mean temperature for that month was 21.8° F. In other words, for a period of 30 days, it took just 196,000 lbs. of steam to raise the outside temperature from 21.8° to 70°, or a rise of 48.2°. And

suppose, in January, 1923, with the valve operated by the regulator, the steam consumption for a 29-day period was 174,000 lbs. and the mean temperature was 17.6°. In the same way as before, we find that it will take 180,000 lbs. of steam over a 30-day period to uary, 1923 would have been (52.4 ÷

"The steam consumption during January, 1923 wiuld have been (52.4 ÷ 48.2) x 196,000, or 213,000 lbs. of the valve was operated by hand. In other words, there was an actual saving of 213,000 lbs. less 180,000 lbs., or 33,000 lbs., which was a saving of 18%.

"The figures here given were taken at random and were used only to explain how we arrived at the percentages of saving. In dollars and cents, during the four coldest months, from December to March inclusive of any one year, we easily save two and one-half times the cost of the equipment. Besides the actual saving in steam, it is no longer necessary to employ a man to watch the temperature at night. All that is necessary now is to set the regulator at night at the temperature desired, and set the alarm for the hour we want the temperature raised. This feature alone has eliminated a big worry."

Efficiencies of Automatic Gas-Fired Storage Systems

An interesting series of tests is reported by the EverHot Heater Company, of Detroit, Mich., to determine the relative efficiency of its self-contained, shell-type storage heater, as compared with a storage heater of the side-arm type. The tests were conducted in the laboratory of the EverHot Heater Company, in Detroit, and covered a period of twenty days. The pilot light on the side-arm heater was set at its normal size. Both heaters were clean and in satisfactory working shape, and care was taken to have the conditions in connection with the test as fair and impartial as possible. All meter readings were recorded so as to be subject to verification.

The heaters were connected as shown in the accompanying illustration (Fig. 1). Each heater was equipped with a recording thermometer and standard-type gas meter having a large 1-ft. dial. Each thermometer was calibrated. In the case of the EverHot heater the actual temperature of the water, when standing on pilot, was 2° higher than that recorded. This was due to the position of the bulb in the heater.

The tests started January 29, 1924 at 8:00 A.M. with both meters at zero. The meters were read February 18, 1924, at 8:00 A.M., the intervening interval being 20 days. The EverHot read 2,459 cu. ft., and the side-arm heater meter, 3,473 cu. ft. The stand-by temperature on the side-arm heater ranged from 130° to 150°, an average of 140°. The stand-by temperature on the EverHot was 140°. The temperature of the water drawn in both cases was the same. The actual amount of water drawn from each heater amounted to 862.5 gal., or 43.12 gal. per day.

At intermittent periods during the day, from 8:00 A.M. to 5:00 P.M., various amounts of water were drawn, ranging from 25 lbs. to 150 lbs. (3 gal. to 18 gal.) At intervals the heaters were let stand from one to two days at a time without any water being drawn to determine the stand-by loss.

The side-arm type of heater had about 60% more storage capacity than the EverHot, but showed a little greater drop in temperature on the large draws. The side-arm heater burned about 80 cu. ft. of gas per hour, as compared with 60 cu. ft. for the EverHot, or about 33% more, while their periods of recovery were longer.

Figs. 2 and 3 (Chart No. 28) are typical of a day's run. A total of 500 lbs. of water, or 62.5 gal., was drawn from each heater in lots varying from 25 to 100 lbs. The relative fluctuations in temperature of the water drawn are indicated very clearly.

During the stand-by period, from 5:00 o'clock at night to 8:00 o'clock in the morning, the temperature in the EverHot was shown to remain constant at about 142° and in the side-arm type it dropped from 148° at 5:00 o'clock to 134° at 12:00 o'clock at night, and by 8:00 o'clock the following morning it had again dropped to about 136°.

During the heating period, from 8:00 o'clock in the morning to 5:00 o'clock at night, the side-arm type burned 178 cu. ft., as against 132 cu. ft. for the EverHot, or 38.4% more gas. During the stand-by period, from 5:00 o'clock at night until 8:00 o'clock in the morning, the side-arm type burned 44 cu. ft. as against 23 cu. ft. for the EverHot.

Figs. 4-5 (Chart No. 34) are considered typical of the performance of the two heaters over a 48-hour period, with no water being drawn. These charts show that the Ever-Hot heater maintained a constant temperature of about 138°, while the temperature on the side-arm heater (equipped with snap-action thermostat) varied from 130° to 150°. During the 48 hours the side-arm heater came on four times and was about to come on again at the close of the test, as the temperature of the water in that heater was down to about 132°. During this 48-hour period, the side-arm heater burned 127 cu. ft. of gas, as against 68 cu. ft. for the Ever-Hot, or 86.7% more.

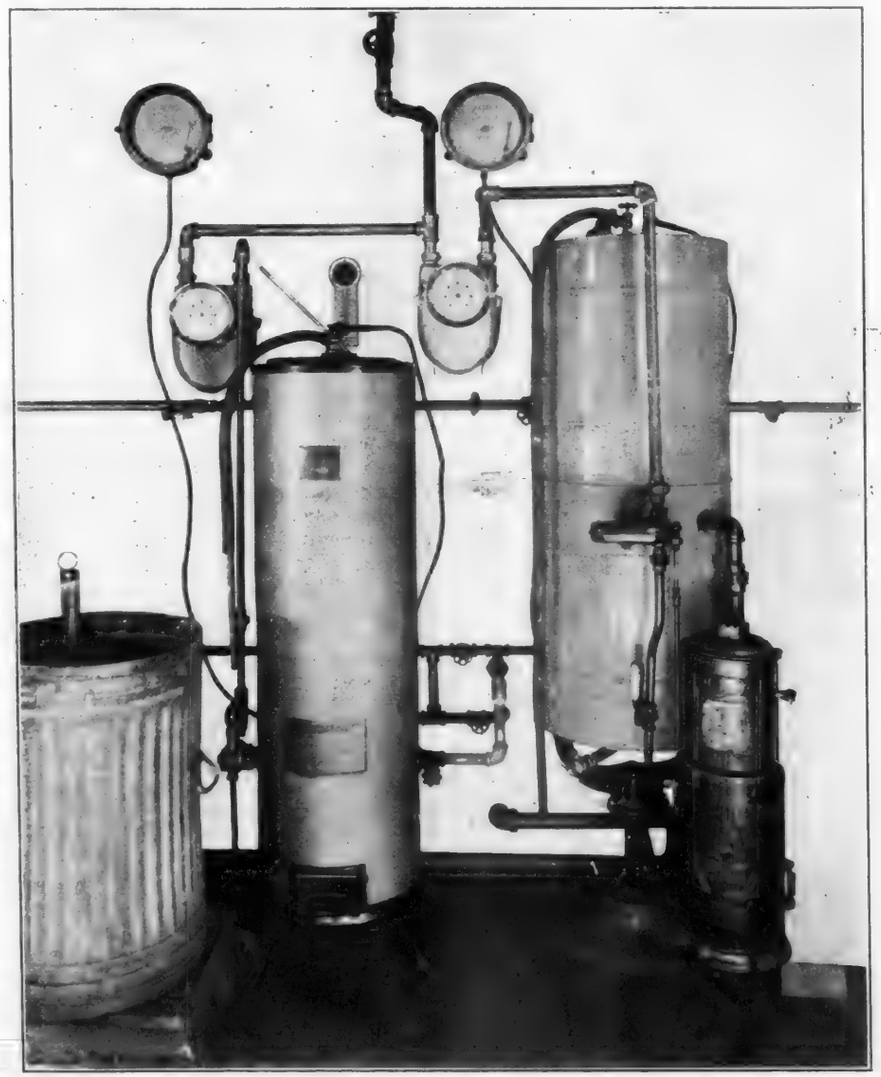
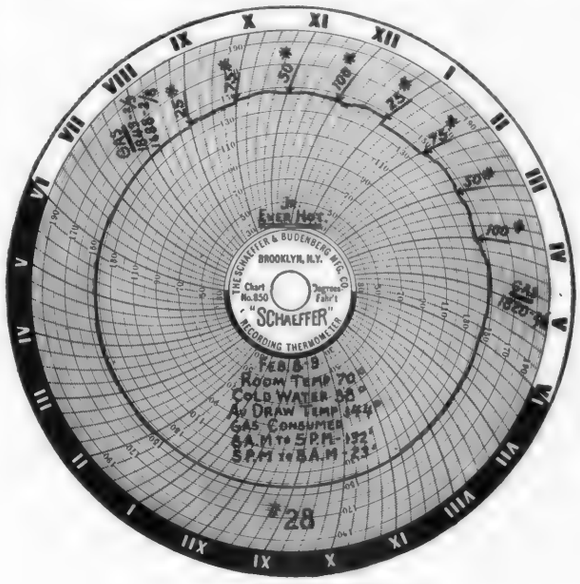


Fig. 1. Set-Up for Testing Automatic Gas-Fired Hot Water Storage System

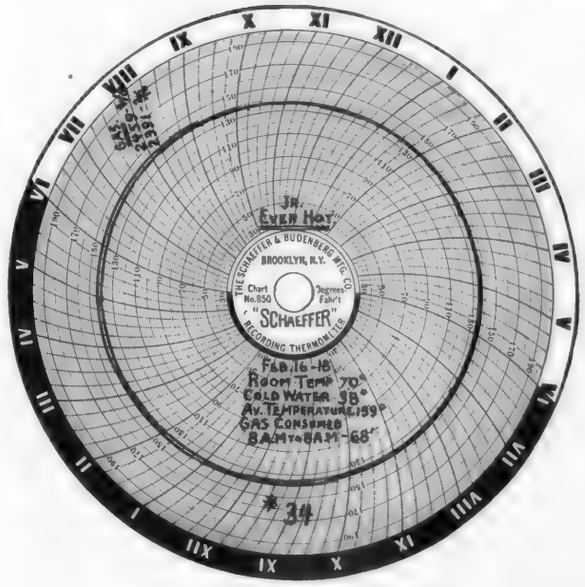
The high thermal efficiency shown by the EverHot heater is attributed to its construction in the form of a shell-type self-contained unit, with an unusually large heating surface. An interesting item also brought out by the test is that



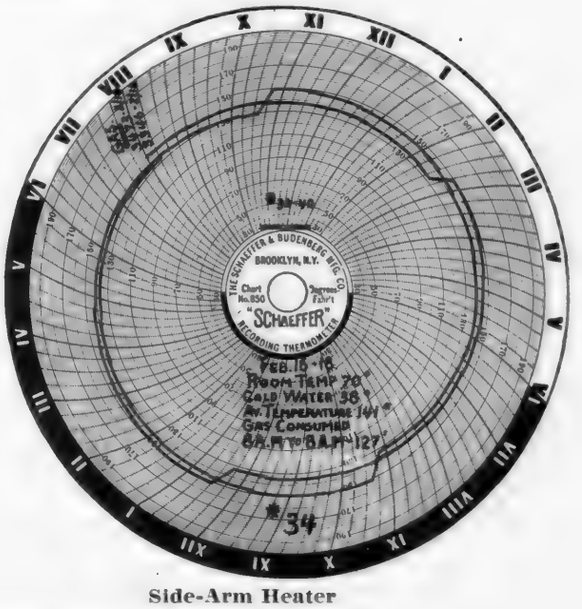
EverHot Heater

Side-Arm Heater

Figs. 2 and 3—Typical Day's Run



EverHot Heater



Side-Arm Heater

Figs. 4 and 5—Performance Test Over a 48-Hour Period

it is possible, with a properly-designed self-contained type of heater, to utilize the heat developed by the pilot light to overcome the radiation loss from the storage tank.

Organization of the Combustion Fuel Oil Burner Company

Announcement is made that the Combustion Fuel Oil Burner Company has been organized in Milwaukee, Wis., to carry on the manufacture and sale of the Combusion fuel-oil burner. This burner has been on the market for four years and, previous to that, had undergone several years' development. It was first marketed by the Combustion Company, which is now succeeded by the now organization.

The officers are: President, John R. Ball, who is also president of the Milwaukee Air Power Pump Company and of the O-E Specialty Company; vice-president, William T. Dean, formerly president of the Combustion Company; secretary, Homer S. Rogers, vice-president of the Milwaukee Air Power Pump Company, and secretary of the O-E Specialty Company. The above-named officers and the following constitute the board of directors: A. R. Ilson, president of Olson & Enzinger, advertising and merchandising specialists, and E. L. Olson, formerly sales manager of R. J. Schwab & Sons Company.

The new company has acquired all the physical assets of the Combustion Company, as well as its patents and good-will. Improvements in method of manufacture and facilities for quantity production, it is stated, are provided in the company's new plant at 8-12 Keefe Avenue, Milwaukee. The organization for financial management is identical with the Milwaukee Air Power Pump Company and the O-E Specialty Mfg. Company. The sales management is in the hands of W. T. Dean, with the assistance and supervision of Olson & Enzinger and E. L. Olson.

St. Louis Chapter Offers Prize

Announcement is made in the *Radiator*, the publication of the St. Louis Chapter, that a prize is to be warded for the best article on some phase of heating and ventilation. The contest will be open to students of Washington University.

Outlook Optimistic

Market Not Losing Ground—Policy of "Watchful Waiting" May Soon Come To An End

Especially Prepared for THE HEATING AND VENTILATING MAGAZINE

By L. W. Alwyn-Schmidt

MANUFACTURERS and business men following closely the movement of the national industrial markets as represented by newspaper reports, the investigations of the National Reserve Banks and Governmental researches, will have found themselves puzzled by the variations in the view taken by these agencies of the market outlook and conditions in the different sections of the country.

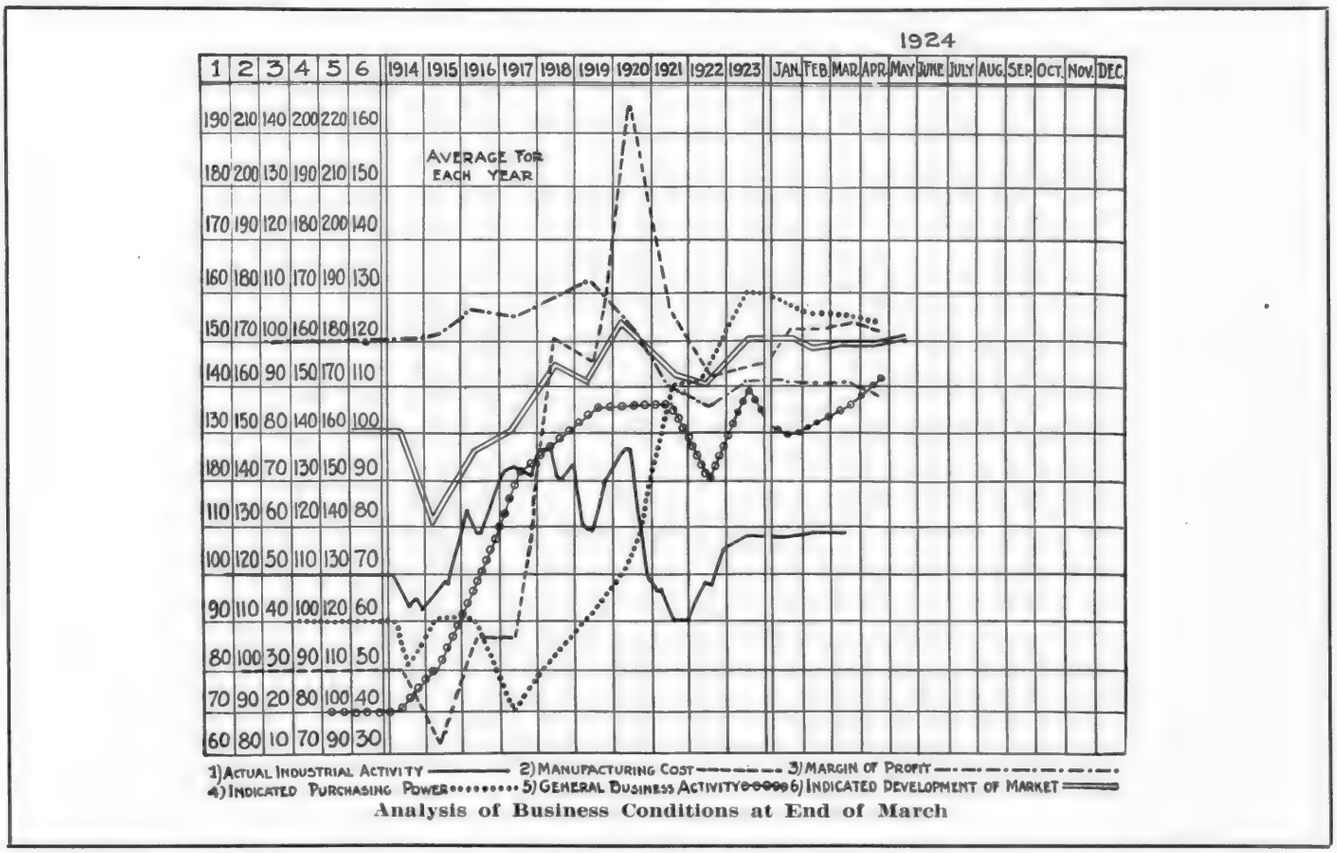
So for instance, we find reported on the same day that the steel industry is extraordinarily busy but that the United States Steel Corporation experiences a considerable reduction in its unfilled orders. Department stores report heavy sales in one city and are almost without business in another. Factories of one and the same industry show variations in turnover which would be unbelievable if similar conditions did not exist all over the country.

And, to make the puzzle complete, after all these conditions are taken into consideration, after they all have been properly valued and placed in their correct relation, there remains the one outstanding fact: the nation's business is not losing ground. There is even evidence that we stand before a renewed forward movement. This forward movement possibly will not be a very large one. But the factors acting upon it have produced in the chart accompanying this article, already a noticeable upward movement of the double line, the forecasting line.

For all this there must be some explanation. It stands to reason, for instance, that a nation like the United States, securing for its working population a high income as expressed by individual wages, must have always available a comparatively large sum to spend for luxuries after it had covered its most indispensible needs. But high wages alone are not sufficient to this end. Uniform employment is required as an additional factor. If wages remain high by the action of artificial means as, for instance, the unionization of any industry, there may still be unemployment.

It is the total wage disbursement and not individual earnings that make for national purchasing power. A reduction in the employment ratio, therefore, may easily lead to a decrease in purchasing power even if wages themselves remain high. Irregularity in employment, as has been the case during the first three months of the present year, no doubt, has been responsible for the oscillation of the purchasing situation in various parts of the country. The condition will probably continue to exist until more regular employment has been secured.

This most likely will be the case with the beginning of real Spring, the coming of which has been deferred somewhat by the weather. Also the lateness of Easter, no doubt, had had much to do with the slackness in such occupations as the dress industries, certain branches of the building industries, and others.



Analysis of Business Conditions at End of March

Manufacturers and retailers apparently have tried to accelerate business by making downward adjustments of the prices of such wares where a cheapening of the prices promises an increase in the demand. It is, however, doubtful, whether price reductions can bring a real relief of the situation. The lean years 1921 and 1922 saw a condition which has often been called a buyers' strike, and such it was. Prices were unattractive and the general consumer was inclined to hord his money until a better opportunity for spending would come.

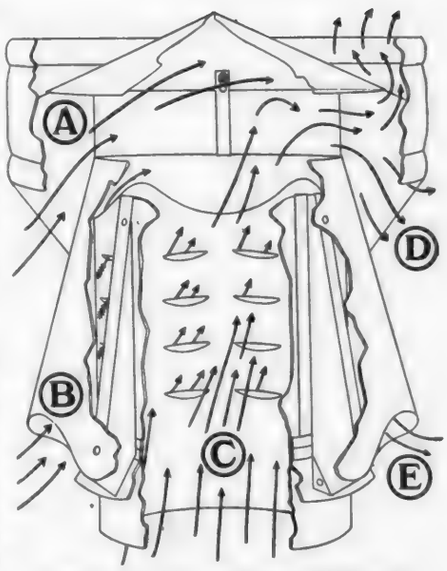
This opportunity came and during the year 1923 considerable purchases were made covering almost all fields of con-

sumers' merchandise, including wearing apparel, house furnishings, etc. These purchases rapidly carried the market far in excess of its normal consumptive capacity, necessitating a readjustment late in 1923 which is still in progress. In very plain language, the consumer having practically depleted himself of reserves in clothing, etc., in the lean years set out to recover his position in 1923. After having filled up his stock he is now able to wait for further developments. The retailers who are in closer touch with the consumer have not failed to sense this condition and are similarly inclined to wait. Hence the apparent tendency to a high diversification of stocks, permitting a rapid change of the store policy in any direction as soon as indications appear for a decided turn in the market.

But this policy of "watchful waiting" can not be continued indefinitely. Either the consumer will get tired of his present attitude or the business world will make a decisive bid for business by offering merchandise, new in character and attractive in price. Common sense seems to counsel the choice of the second eventuality.

Even with the slightly reduced purchasing power of the consumer (and his disappointment resulting from the desultory way in which Congress has treated the desire for a change in the tax imposition) there is left a large private reserve of money. To turn this purchasing reserve into active purchasing can not be too difficult a matter. It, no doubt, can be accomplished by a really tempting offer.

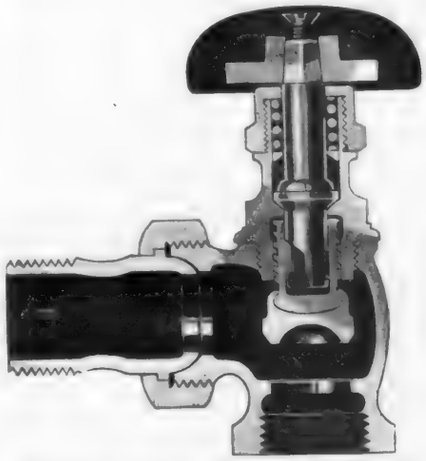
This is a time where optimism should govern the policy of the industrial producer and the retailer. The two should co-operate by pressing upon the consumer their own conception of the situation. To discourage the consumer by insufficient or broken stocks is the worst policy that can prevail. Unfortunately it is just the policy followed by the large majority of our retail houses. It should be changed soon so that the market is well provided for the Summer and gets firmly settled for the Autumn season.



Course of Air Currents Through Buckley Multi-Syphon Ventilator

New Trade Publications

MARSH RE-ENFORCED PACKLESS HOT WATER VALVES, a new product designed to overcome what the manufacturers point out is one of the chief handicaps of water heating—the fact that many water valves in service cannot be opened or closed six months after installation—are described in a folder issued by the Marsh Valve Co., Dunkirk, N. Y. The manufacturers state that they use their regular packless feature in the new valves and that the valves can be opened and closed readily, and will hold high pressure suitable to forced circulation. With the use of these valves, the folder states, water circulation for each radiator, graduating for same or balancing system, can be increased from nothing to full pipe capacity and held or locked at any intermediate point, if desired, by turning the dial so that the stop on same will register against the indicator or pointer and locking dial in this position, preventing further opening of valve or turning of wheel or lever handle to the left.



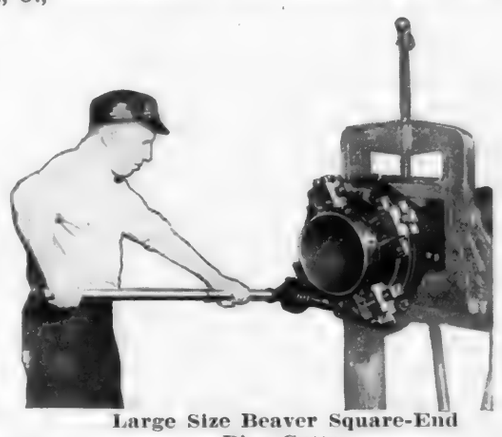
March Re-Enforced Packless Hot Water Valve

BARBER PATENTED GAS BURNERS, manufactured by the Cleveland Gas Burner & Appliance Co., Cleveland, O., are described in a folder recently issued and designed for distribution by dealers. Type "S" and "Z" burners are especially designed for water heaters, small steam boilers, floor furnaces, coffee urns, liquid tanks, coal stoves and ranges and similar appliances, while Types "G," "L," and "M" are intended for small steam boilers, volcanizer boilers, liquid tanks, metal pots, candy stoves, coal stoves, water heaters, French ranges and similar appliances having combustion chambers or fire boxes, 9 in. or more deep. Tables of gas consumption are included for each type, for both natural and artificial gas.

VALVE WORLD for April, 1924, published by the Crane Co., Chicago, contains, among other things, an analysis of the organization of the business of Crane Co., published in response to numerous requests. The purpose of the organization is defined as: 1—useful and desirable production; 2—economical and effective distribution; 3—continuous, satisfying service.

BETTER VENTILATION AT LESS EXPENSE, an attractive booklet regarding Buckley Multi-Syphon ventilator, recently patented, has been received from the manufacturers, the American Cornice Works Co., Wichita, Kan. Instead of depending upon only a small surface, through which the "dead" air may be carried off, the booklet points out, the Buckley Multi-Syphon ventilators have a series of several vertical rows of vents or openings, extending entirely around the inner shell or base, offering maximum syphoning power. Thus, it is claimed, the "dead" air is literally syphoned from the room in a steady, never-varying flow. The ventilators are so made that they may be cleaned readily. Size 4 x 9 in. Pp. 16 and cover.

BEAVER SQUARE-END PIPE CUTTERS, in new large sizes, are described in an envelope-size folder issued by the Bor-



Large Size Beaver Square-End Pipe Cutter

den Co., Warren, O. Three new large sizes have been added to the Beaver line. They are known as the new 106, 108 and 112 Beaver pipe cutters and operate on the same principle as other Beaver cutters, differing only in the method of applying the principle. The variation, the manufacturers state, enables the operator to cut the larger sizes by hand, or to apply power when desired.

WILLIE WILLIAMS PORTABLE POWER PIPE MACHINE, the newest and smallest member of the Williams family of thread-cutting machines, is described in

Views Showing Construction and Operation of Willie Williams Portable Power Pipe Machine

a recent catalog of the Williams Tool Corporation, Erie, Pa. The day of the hand stock and die is passing, the catalog states, in pointing out that its newest machine is really a power portable threader and has all of the features necessary to do the work the way it should be done. Every operation, from picking up the pipe from the floor to laying it down, was considered in producing the Willie Williams power pipe threader. The catalog carries numerous illustrations showing the machine in operation under varying conditions. It is equipped so that it can be operated by hand in case power is not available on a particular job. Size 6 x 9 in. Pp. 32.

New Publications

Rules for the Construction of Low-Pressure Cast-Iron Heating Boilers, prepared by the Boiler Code Committee of the American Society of Mechanical Engineers, has been issued by the National Boiler and Radiator Manufacturers' Association, whose headquarters are at Geneva, N. Y. These rules apply to all steam boilers for operation at pressures not exceeding 15 lbs. per square inch, and to water boilers operated at pressures not exceeding 160 lbs. per square inch, or temperatures not exceeding 250° F. For conditions exceeding those specified above, cast-iron construction is not permitted. The rules cover, in order, such points as boiler openings, installation, fittings and appliances and hydrostatic tests.

Under "Installation," the rules provide for the expansion and contraction of steam mains connected to boilers by requiring substantial anchorage at suitable points, so that there shall be no undue strain transmitted to the boiler. When feed or make-up water is introduced from a pressure line, it must be connected to the piping system and not directly to the boiler. If valves are used in the supply and return mains, they must be locked and sealed open and bear tags stating that provision must be made to prevent pressure from building up in boiler whenever the valves are closed. It is recommended that no valves be placed in the supply and return mains of a single boiler installation. Another rule is that when a valve is placed in the top connection from a hot-water supply boiler to a storage tank, an additional connection without valve must be made between the boiler and top of storage tank. Every boiler must have proper outlet connections for the required safety or water-relief valves, independent of any other connection outside the boiler. A steam-equalizing pipe between boilers is not to be considered as a connection outside of the boiler in applying these requirements.

Fittings and Appliances

Under "Fittings and Appliances," the rules go at length into such matters as safety valves, water-relief valves, their minimum allowable sizes; also steam gauges, pressure or altitude gauges, thermometers, temperature combustion regulators, pressure combustion regulators, bottom blow-off, water-gauge glasses, gauge cocks, water-column pipes and fusible plugs. Size 3½ x 6¼ in. Pp. 12.

Official Bulletin of the Heating and Piping Contractors' National Association, for April, 1924, contains announcements of the association's forthcoming convention in Atlantic City, N. J., May 26-29. This journal which now appears in its new dress, including an artistic cover design, contains a noteworthy article by William G. Bergner, secretary of the East St. Louis Association, on "Why Do Business for Love?" W. H. Driscoll, chairman of the association's Board of Directors, contributes an account of the events which led up to the ruling by the National Board of Jurisdictional Awards which placed the control of temporary heating plants in the hands of the steam fitters. F. Paul Anderson, director of the A. S. H. & V. E. Research Laboratory, contributes a digest of his address at the last convention of the association, in Chicago, on "The Heating and Piping Contractor a Civilizer."

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE published monthly at Albany, N. Y., for April 1, 1924.

State of New York, County of New York, ss:

Before me, a notary public in and for the State aforesaid, personally appeared Arthur S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of said publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443 Postal Laws and Regulations printed on the reverse of this form to wit:

1. That the names and addresses of the publishers, editor, managing editor, and business managers are:

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Editor, Arthur S. Armagnac, 1123 Broadway, New York, N. Y.

Managing Editor, None.

Business Manager, Gustave Petersen, 1123 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or if a corporation, give its name and the name and address of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Arthur S. Armagnac, 1123 Broadway, New York.

Gustave Petersen, 1123 Broadway, New York, N. Y.

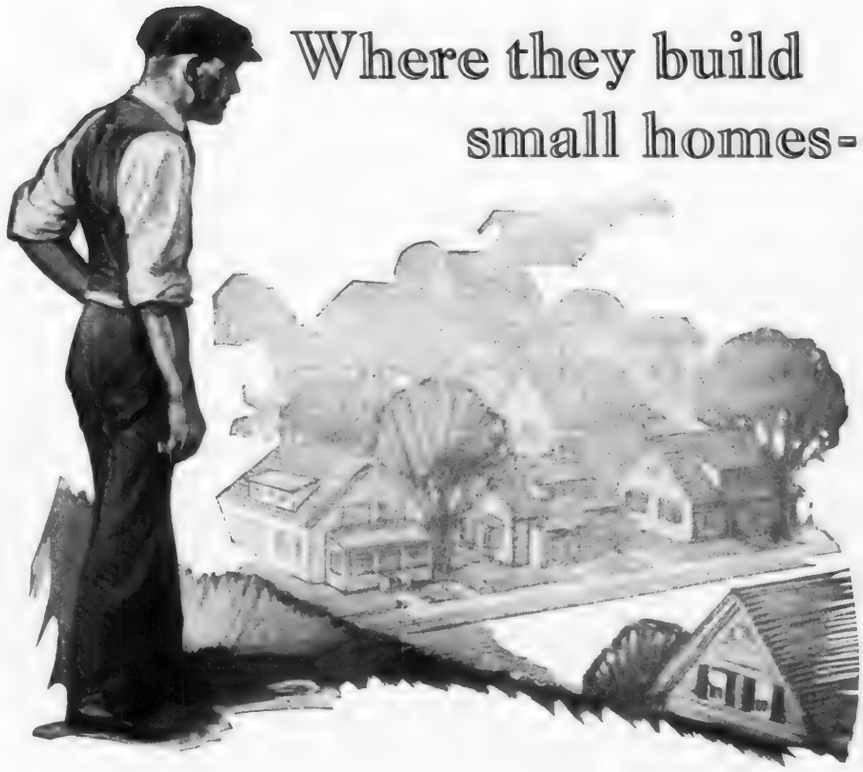
3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above giving the names of the owners, stockholders, and security holders, if any, contain, not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than of a bonifide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

ARTHUR S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 26th day of March, 1924.

A. L. Scantlebury,
Notary Public Kings County No. 631.
Certificate filed in New York.
County Clerk's No. 455.
New York County Registers No. 5479.
(My term expires March 30th, 1925.)



Where they build small homes-

they'll want these valves

THOUSANDS of home-builders are just waiting to be told about *Super-Packless Valves*. And they depend on you to tell them.

Like electric light took the place of gas—like the radiator replaced the register, the *Super-Packless* is now accepted as the only radiator valve suitable for refined surroundings. There are three big appeals to the home-builder:

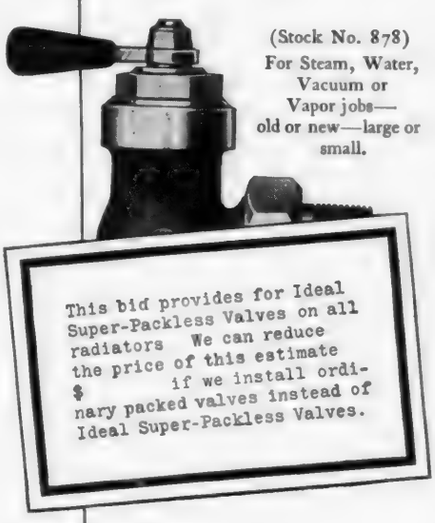
1. Protects from unsightly, destructive leaks.
2. Opens or closes with one easy turn.
3. Actually *lowers* cost—because it eliminates annual repacking.

Super-Packless Valves make the small jobs more profitable for you—and cost the home-owner less than one leak might cost him.

AMERICAN RADIATOR COMPANY
IDEAL Boilers and AMERICAN Radiators for every heating need
1807 Elmwood Avenue Dept. S Buffalo, N.Y.

SUPER-PACKLESS
RADIATOR VALVES

and put this sticker on every bid



(Stock No. 878)
For Steam, Water, Vacuum or Vapor jobs—old or new—large or small.

This bid provides for Ideal Super-Packless Valves on all radiators We can reduce the price of this estimate $ if we install ordinary packed valves instead of Ideal Super-Packless Valves.

Get "stickers" free from our nearest branch

The "alternate" bid sticker is intended to make the home-owner ask you about Super-Packless Valves. Place a sticker on every bid. It keeps the prospect's mind open, and gives you a chance to adjust other items—if necessary.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

One-Column Steam, Enclosed, Two Top Registers

STEAM AT 215°F.

1 COLUMN RADIATOR

ENCLOSED RATING TWO TOP REGISTERS

SECTIONS	LENGTH IN INCHES	38"			32"			26"			23"			20"		
		Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D=3"	D=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D=3"	D=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D=3"	D=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D=3"	D=6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D=3"	D=6"
2	5	6	5.1	6.6	5	4.4	5.8	4	3.6	4.8	3⅓	3.1	4.1	3	2.7	3.7
3	7½	9	6.1	9.1	7½	6.2	7.9	6	4.9	6.5	5	4.2	5.5	4½	3.8	5.0
4	10	12	8.8	11.5	10	7.5	9.9	8	6.2	8.1	6⅔	5.3	6.1	6	4.8	6.3
5	12½	15	10.6	13.9	12½	9.2	11.1	10	7.5	9.9	8⅓	6.4	8.4	7½	5.9	7.7
6	15	18	12.5	16.3	15	10.8	14.1	12	8.9	11.6	10	7.5	9.0	9	6.8	8.9
7	17½	21	14.3	18.7	17½	12.4	16.2	14	10.2	13.3	11⅔	8.6	11.3	10½	7.9	10.4
8	20	24	16.2	21.2	20	14.0	18.4	16	11.5	15.0	13⅓	9.8	12.8	12	8.9	11.6
9	22½	27	18.1	23.6	22½	15.7	20.5	18	12.9	16.8	15	11.0	14.1	13½	10.0	13.1
10	25	30	19.9	26.1	25	17.3	22.6	20	14.2	18.5	16⅔	12.1	15.8	15	10.9	14.4
11	27½	33	21.8	28.5	27½	18.9	24.7	22	15.5	20.2	18⅓	13.2	17.3	16½	12.0	15.7
12	30	36	23.7	30.9	30	20.5	26.8	24	16.3	21.3	20	14.3	18.7	18	13.0	17.1
13	32½	39	25.5	33.4	32½	22.1	28.9	26	18.1	23.7	21⅔	15.5	20.2	19½	14.1	18.4
14	35	42	27.3	35.7	35	23.7	31.0	28	19.4	25.4	23⅓	16.6	21.7	21	15.1	19.7
15	37½	45	29.3	38.3	37½	25.4	33.2	30	20.8	27.2	25	17.7	23.2	22½	16.1	21.1
16	40	48	31.1	40.6	40	26.9	35.2	32	22.1	28.9	26⅔	18.9	24.7	24	17.2	22.4
17	42½	51	32.8	42.9	42½	28.3	37.3	34	23.4	30.6	28⅓	19.1	26.1	25½	18.4	24.1
18	45	54	34.8	45.3	45	30.0	39.7	36	24.8	32.4	30	21.1	27.5	27	19.7	25.8
19	47½	57	36.6	47.9	47½	31.7	41.5	38	26.1	34.2	31⅔	22.2	29.1	28½	20.2	26.4
20	50	60	38.4	50.2	50	33.3	43.5	40	27.4	35.9	33⅓	23.3	30.4	30	21.2	27.7
21	52½	63	40.1	52.4	52½	34.8	45.5	42	28.7	37.5	35	24.4	31.9	31½	22.2	29.1
22	55	66	41.9	54.9	55	36.5	47.7	44	30.3	39.6	36⅔	25.5	33.4	33	23.2	30.3
23	57½	69	43.7	57.2	57½	37.1	49.6	46	31.3	41.0	38⅓	26.6	34.6	34½	24.2	31.7
24	60	72	45.5	59.5	60	39.6	51.8	48	33.0	43.1	40	27.8	36.3	36	25.2	33.0
25	62½	75	47.8	61.1	62½	41.1	53.7	50	34.0	44.4	41⅔	28.8	37.7	37½	26.3	34.3
26	65	78	49.3	64.4	65	42.7	55.8	52	35.2	46.1	43⅓	29.7	38.8	39	27.4	35.8
27	67½	81	50.1	66.9	67½	44.4	58.1	54	36.6	47.9	45	30.1	40.6	40½	28.3	37.0
28	70	84	52.8	68.1	70	45.8	59.9	56	38.2	49.9	46⅔	32.1	41.1	42	29.3	38.3
29	72½	87	54.5	71.2	72½	47.3	61.9	58	39.0	51.0	48⅓	33.2	43.4	43½	30.3	39.6
30	75	90	56.3	73.7	75	48.9	64.0	60	40.3	52.7	50	34.3	44.9	45	31.2	40.8
31	77½	93	57.9	75.8	77½	50.4	65.9	62	41.5	54.3	51⅔	35.3	46.2	46½	32.6	42.0
32	80	96	59.9	78.3	80	52.1	68.1	64	42.9	56.1	53⅓	36.5	47.7	48	33.2	43.4
33	82½	99	61.5	80.4	82½	53.3	69.7	66	44.1	57.6	55	37.4	48.1	49½	34.1	44.6
34	85	102	63.4	82.9	85	54.1	71.9	68	45.4	59.4	56⅔	38.5	50.4	51	35.1	45.9
35	87½	105	64.9	84.9	87½	56.4	73.8	70	46.5	60.9	58⅓	39.6	51.8	52½	36.0	47.1
36	90	108	66.8	87.4	90	57.1	73.8	72	47.9	62.6	60	40.7	53.2	54	37.1	48.5
37	92½	111	68.4	89.4	92½	59.4	77.7	74	49.0	64.1	61⅔	41.7	54.5	55½	38.1	49.5
38	95	114	70.2	91.2	95	60.1	79.7	76	50.4	65.9	63⅓	42.8	55.9	57	38.9	50.9
39	97½	117	71.8	94.9	97½	61.6	80.6	78	51.5	67.3	65	43.7	57.0	58½	39.1	52.3
40	100	120	73.5	96.2	100	63.2	83.6	80	52.8	69.1	66⅔	44.9	58.7	60	41.0	53.6

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RADIATOR RATINGS—1-COL. STEAM, ENCLOSED, TWO-TOP REGISTERS | No. 14-L

Copies of this Data Sheet, printed separately, 5 cents each

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Two-Column Steam, Enclosed, Two Top Registers

STEAM AT 215°F.

2 COLUMN RADIATOR

REGISTERS 60% OPEN

ENCLOSED RATING TWO TOP REGISTERS

SECTIONS	LENGTH IN INCHES	45"			38"			32"			26"			23"			20"		
		Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D= 3"	D= 6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D= 3"	D= 6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D= 3"	D= 6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D= 3"	D= 6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D= 3"	D= 6"	Actual Surface	Equivalent surface at 250 b.t.u. per sq. ft. D= 3"	D= 6"
2	5	10	7.7	10.1	8	6.4	8.4	6⅔	5.2	6.8	5⅓	4.4	5.8	4⅔	4.0	5.3	4	3.4	4.5
3	7½	15	10.6	13.9	12	8.7	11.4	10	7.5	9.8	8	5.7	7.8	7	5.5	7.1	6	4.0	6.3
4	10	20	13.3	17.4	16	10.9	14.3	13⅓	9.4	12.2	10⅔	7.9	10.3	9⅓	6.9	9.0	8	6.0	7.9
5	12½	25	15.1	20.9	20	13.1	17.2	16⅔	11.4	14.1	13⅓	9.4	12.3	11⅔	9.0	11.8	10	7.3	9.5
6	15	30	19.2	25.1	24	15.6	20.4	20	13.4	17.5	16	11.2	14.6	14	9.9	12.9	12	8.5	11.2
7	17½	35	21.8	28.6	28	18.0	23.5	23⅓	15.4	20.1	18⅔	12.9	16.8	16⅓	11.3	14.8	14	9.9	12.9
8	20	40	24.7	32.3	32	20.3	26.5	26⅔	17.5	22.9	21⅓	14.4	18.9	18⅔	12.8	16.7	16	11.2	14.6
9	22½	45	27.6	36.0	36	22.6	29.5	30	19.5	25.5	24	15.1	20.9	21	14.3	18.7	18	12.5	16.3
10	25	50	30.4	39.8	40	24.9	32.6	33⅓	21.5	28.1	26⅔	17.7	23.2	23⅓	15.7	20.6	20	13.8	18.0
11	27½	55	33.2	43.4	44	27.2	35.6	36⅔	23.5	30.7	29⅓	19.2	25.2	26⅓	17.2	22.5	22	15.0	19.6
12	30	60	36.0	47.1	48	29.6	38.8	40	25.4	33.2	32	20.4	27.3	28	18.7	24.4	24	16.4	21.4
13	32½	65	38.9	50.9	52	31.9	41.7	43⅓	27.4	35.8	34⅔	22.4	29.3	30⅓	20.0	26.2	26	17.6	23.0
14	35	70	41.7	54.6	56	34.2	44.7	46⅔	29.4	38.4	37⅓	24.1	31.5	32⅔	21.5	28.1	28	18.9	24.6
15	37½	75	44.5	58.1	60	35.7	47.8	50	31.3	40.1	40	25.7	33.6	35	22.9	30.0	30	20.2	26.4
16	40	80	47.3	61.8	64	38.7	50.7	53⅓	33.3	43.5	42⅔	27.3	35.7	37⅓	24.4	32.9	32	21.5	28.1
17	42½	85	50.1	65.5	68	41.0	53.6	56⅔	35.2	46.1	45⅓	28.9	37.7	39⅔	25.7	33.7	34	22.6	29.6
18	45	90	52.8	69.1	72	43.5	56.9	60	37.3	48.8	48	30.6	40.0	42	27.3	35.7	36	23.9	31.3
19	47½	95	55.6	72.8	76	45.8	59.8	63⅓	39.2	51.3	50⅔	32.0	41.8	44⅓	28.7	37.5	38	25.2	32.1
20	50	100	58.2	76.2	80	47.8	62.5	66⅔	41.1	53.7	53⅓	34.2	44.1	46⅔	30.2	39.4	40	26.4	34.5
21	52½	105	61.2	79.1	84	50.2	65.6	70	43.2	56.4	56	35.3	46.2	49	31.6	41.3	42	27.8	36.3
22	55	110	63.8	83.5	88	52.4	68.5	73⅓	44.1	58.8	58⅔	36.9	48.4	51⅓	33.1	43.3	44	28.9	37.8
23	57½	115	66.8	87.4	92	54.7	71.6	76⅔	47.1	61.6	61⅓	38.6	50.5	53⅔	34.5	45.1	46	30.2	39.6
24	60	120	69.4	90.7	96	56.9	74.4	80	48.9	64.0	64	40.2	52.5	56	33.8	46.8	48	31.5	41.1
25	62½	125	72.2	94.4	100	59.3	77.6	83⅓	50.9	66.6	66⅔	41.7	54.6	58⅓	37.2	48.7	50	32.8	42.8
26	65	130	74.8	97.8	104	61.4	80.3	86⅔	52.7	68.9	69⅓	43.6	56.1	60⅔	39.1	51.2	52	34.1	44.5
27	67½	135	77.4	101.2	108	63.7	83.3	90	54.8	71.7	72	44.9	58.7	63	40.2	52.6	54	35.2	46.1
28	70	140	80.0	104.6	112	65.7	85.9	93⅓	56.5	73.9	74⅔	46.7	61.0	65⅓	41.5	54.3	56	36.5	47.8
29	72½	145	82.9	108.5	116	68.2	89.2	96⅔	58.7	76.8	77⅓	48.1	62.9	67⅔	42.9	56.1	58	37.7	49.3
30	75	150	85.9	111.9	120	70.2	91.8	100	60.3	78.9	80	49.5	64.8	70	44.3	57.9	60	38.9	50.9
31	77½	155	88.1	115.3	124	72.2	94.4	103⅓	62.3	81.5	82⅔	50.8	66.5	72⅓	45.5	59.6	62	39.9	52.2
32	80	160	90.4	118.2	128	74.6	97.5	106⅔	64.0	83.7	85⅓	52.7	68.9	74⅔	46.9	61.4	64	41.1	53.8
33	82½	165	93.1	121.7	132	76.6	100.1	110	65.7	85.9	88	54.0	70.6	77	48.2	63.1	66	42.4	55.1
34	85	170	94.9	125.4	136	78.8	103.0	113⅓	67.8	88.7	90⅔	55.4	72.5	79⅓	49.7	64.9	68	43.7	57.1
35	87½	175	98.3	128.5	140	80.7	106.6	116⅔	69.6	90.1	93⅓	57.1	74.6	81⅔	50.9	66.6	70	44.8	58.6
36	90	180	101.2	132.3	144	83.1	108.7	120	71.5	93.5	96	58.6	76.7	84	52.4	68.5	72	46.0	60.2
37	92½	185	103.9	135.9	148	85.3	111.5	123⅓	73.5	96.1	98⅔	60.3	78.9	86⅓	53.9	70.5	74	47.3	61.9
38	95	190	106.1	138.8	152	87.2	114.1	126⅔	75.1	98.2	101⅓	61.9	80.9	88⅔	55.2	72.2	76	48.5	63.4
39	97½	195	108.1	142.6	156	89.7	117.3	130	77.1	100.8	104	63.3	82.8	91	56.6	74.0	78	49.7	64.9
40	100	200	111.8	146.2	160	92.0	120.4	133⅓	79.0	103.4	106⅔	65.0	85.0	93⅓	57.1	75.8	80	50.8	66.5

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RADIATOR RATINGS—2-COL. STEAM, ENCLOSED, TWO-TOP REGISTERS | No. 14-M

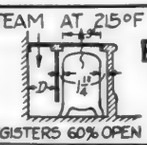
Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Three-Column Steam, Enclosed, Two Top Registers

3 COLUMN RADIATOR



ENCLOSED RATING TWO TOP REGISTERS

SECTIONS	LENGTH IN INCHES	45" Actual Surface	45" Equivalent surface at 250 btu per sq. ft. D=3"	45" D=6"	38" Actual Surface	38" Equivalent surface at 250 btu per sq. ft. D=3"	38" D=6"	32" Actual Surface	32" Equivalent surface at 250 btu per sq. ft. D=3"	32" D=6"	26" Actual Surface	26" Equivalent surface at 250 btu per sq. ft. D=3"	26" D=6"	22" Actual Surface	22" Equivalent surface at 250 btu per sq. ft. D=3"	22" D=6"	18" Actual Surface	18" Equivalent surface at 250 btu per sq. ft. D=3"	18" D=6"
2	5	12	8.6	11.3	10	7.4	9.7	9	6.1	9.1	7½	5.6	7.8	6	4.9	6.5	4½	3.7	4.8
3	7½	18	11.8	15.4	15	10.1	13.3	13½	9.5	12.4	11¼	8.1	10.6	9	6.7	8.8	6¾	5.0	6.5
4	10	24	14.8	19.4	20	12.7	16.7	18	11.9	16.0	15	10.3	13.4	12	8.5	11.1	9	6.6	8.6
5	12½	30	17.9	23.5	25	15.4	20.1	22½	14.3	18.7	18¾	12.4	16.2	15	10.3	13.4	11¼	7.9	10.4
6	15	36	21.1	27.5	30	18.3	23.1	27	16.8	20.0	22½	14.6	19.1	18	12.0	15.7	13½	9.4	12.3
7	17½	42	24.2	31.7	35	20.9	27.4	31½	19.4	25.4	26¼	16.7	21.8	21	13.9	18.2	15¾	10.7	14.0
8	20	48	27.4	35.9	40	23.9	31.3	36	21.1	28.7	30	19.1	24.1	24	15.6	20.4	18	12.2	15.9
9	22½	54	30.9	40.4	45	26.6	34.8	40½	24.8	32.4	33¾	21.1	27.5	27	17.6	22.1	20¼	13.5	17.6
10	25	60	33.9	44.4	50	29.3	38.3	45	27.2	35.5	37½	23.4	30.6	30	19.3	25.2	22½	14.9	19.5
11	27½	66	36.9	48.2	55	32.2	42.1	49½	29.6	38.7	41¼	25.5	33.3	33	20.1	27.5	24¾	16.2	21.2
12	30	72	40.2	52.6	60	34.8	45.6	54	32.2	42.2	45	27.8	36.3	36	22.9	30.0	27	17.6	23.0
13	32½	78	43.6	57.0	65	37.6	49.1	58½	34.9	45.6	48¾	29.8	38.9	39	24.3	31.8	29¼	19.0	24.9
14	35	84	45.9	61.4	70	40.5	52.1	63	37.2	48.7	52½	31.1	41.1	42	26.5	34.6	31½	20.5	26.8
15	37½	90	49.7	65.0	75	42.9	56.1	67½	39.9	52.2	56¼	34.4	44.1	45	28.4	37.1	33¾	21.8	28.5
16	40	96	52.0	69.4	80	45.8	59.8	72	42.6	55.7	60	37.2	47.9	48	29.1	39.2	36	23.2	30.3
17	42½	102	56.4	73.7	85	48.7	63.7	76½	45.2	59.2	63¾	38.9	50.9	51	31.9	41.7	38¼	24.6	32.2
18	45	108	58.1	77.1	90	51.5	67.3	81	47.2	61.8	67½	40.8	53.4	54	33.7	44.0	40½	26.0	34.0
19	47½	114	62.3	81.4	95	53.7	70.2	85½	50.1	65.5	71¼	43.1	56.4	57	35.5	46.5	42¾	27.3	35.7
20	50	120	65.1	85.7	100	56.6	73.1	90	52.7	68.9	75	45.4	59.3	60	37.4	48.1	45	28.8	37.7
21	52½	126	68.8	89.9	105	59.3	77.6	94½	54.7	71.5	78¾	47.1	61.6	63	38.9	50.1	47¼	30.2	39.4
22	55	132	72.0	94.2	110	62.2	81.3	99	57.3	74.9	82½	49.3	64.5	66	41.0	53.6	49½	31.5	41.2
23	57½	138	75.2	98.5	115	65.1	85.1	103½	59.9	78.3	86¼	51.6	67.5	69	42.1	56.2	51¾	32.9	43.1
24	60	144	77.7	101.7	120	67.1	87.7	108	62.5	81.7	90	53.8	70.4	72	44.5	58.1	54	33.3	44.8
25	62½	150	80.9	105.8	125	68.9	91.4	112½	65.1	85.1	93¾	56.1	73.4	75	46.3	60.6	56¼	35.1	45.9
26	65	156	84.1	108.8	130	72.7	95.0	117	67.7	88.5	97½	58.0	75.9	78	48.2	62.1	58½	37.2	48.7
27	67½	162	87.4	114.2	135	75.5	98.7	121½	69.5	90.9	101¼	59.9	78.4	81	49.5	64.7	60¾	38.4	50.2
28	70	168	88.5	117.0	140	78.3	102.3	126	71.7	93.8	105	62.1	81.2	84	51.4	67.2	63	39.7	51.9
29	72½	174	92.7	121.2	145	81.1	105.1	130½	74.7	97.7	108¾	64.4	84.2	87	53.2	69.5	65¼	41.1	53.7
30	75	180	95.9	125.5	150	82.9	108.4	135	77.2	101.2	112½	66.5	86.9	90	54.9	71.9	67½	42.3	55.3
31	77½	186	98.5	127.8	155	86.6	111.9	139½	79.8	104.4	116¼	68.8	89.9	93	56.8	74.3	69¾	43.6	57.1
32	80	192	102.3	133.8	160	88.4	115.6	144	82.4	107.7	120	70.1	92.8	96	58.6	76.7	72	44.9	58.7
33	82½	198	105.5	137.1	165	91.1	119.2	148½	83.1	108.8	123¾	73.2	95.7	99	59.9	78.7	74¼	46.3	60.6
34	85	204	108.7	142.1	170	93.9	122.8	153	86.5	113.1	127½	75.4	98.6	102	61.7	80.7	76½	47.6	62.3
35	87½	210	110.6	144.6	175	95.5	124.1	157½	89.2	116.6	131¼	77.2	101.1	105	63.5	83.0	78¾	48.6	63.8
36	90	216	113.7	148.7	180	98.3	128.5	162	91.7	119.9	135	79.1	104.6	108	65.3	85.3	81	50.5	66.0
37	92½	222	116.9	152.8	185	101.0	132.1	166½	93.9	122.8	138¾	81.3	106.8	111	67.1	87.7	83½	51.9	67.9
38	95	228	119.1	156.9	190	103.7	135.7	171	96.4	126.1	142½	83.2	108.8	114	68.8	89.9	85½	53.0	69.3
39	97½	234	123.2	161.1	195	106.5	139.2	175½	98.6	128.8	146¼	85.2	111.4	117	70.1	91.6	87¾	54.1	70.8
40	100	240	126.8	165.8	200	109.2	142.8	180	100.7	132.2	150	87.1	113.9	120	71.8	93.8	90	55.8	72.9

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RADIATOR RATINGS—3-COL. STEAM, ENCLOSED, TWO-TOP REGISTERS — No. 14-N

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Four-Column Steam, Enclosed, Two Top Registers

STEAM AT 215°F.

4 COLUMN RADIATOR

ENCLOSED RATING TWO TOP REGISTERS

SECTIONS	LENGTH IN INCHES	45"			38"			32"			26"			22"			18"		
		Actual Surface	Equivalent surface at 280 b.t.u. Per sq. ft.		Actual Surface	Equivalent surface at 280 b.t.u. per sq. ft.		Actual Surface	Equivalent surface at 280 b.t.u. per sq. ft.		Actual Surface	Equivalent surface at 280 b.t.u. per sq. ft.		Actual Surface	Equivalent surface at 280 b.t.u. per sq. ft.		Actual Surface	Equivalent surface at 280 b.t.u. per sq. ft.	
			D= 3"	D= 6"		D= 3"	D= 6"		D= 3"	D= 6"		D= 3"	D= 6"		D= 3"	D= 6"		D= 3"	D= 6"
2	6	20	13.7	17.9	16	11.2	14.6	13	9.4	12.3	10	7.4	9.7	8	6.2	8.1	6	4.7	6.2
3	9	30	18.6	24.3	24	15.2	19.8	19½	12.7	16.7	15	10.1	13.3	12	8.4	10.1	9	6.4	8.4
4	12	40	23.4	30.6	32	19.1	24.1	26	16.1	21.1	20	12.8	16.7	16	10.6	13.9	12	8.1	10.6
5	15	50	28.3	36.1	40	23.1	30.2	32½	19.4	25.4	25	15.9	20.2	20	12.8	16.7	15	9.8	12.8
6	18	60	33.3	43.5	48	27.4	35.9	39	22.9	29.9	30	18.3	23.9	24	15.0	19.6	18	11.6	15.1
7	21	70	36.4	50.2	56	31.4	41.1	45½	26.4	34.5	35	20.1	27.5	28	17.4	22.8	21	13.3	17.4
8	24	80	43.5	56.9	64	35.6	46.6	52	29.8	39.1	40	23.9	31.2	32	19.6	25.7	24	15.1	19.7
9	27	90	48.5	63.4	72	39.7	51.9	58½	33.3	43.6	45	26.5	34.7	36	21.9	28.6	27	16.8	22.0
10	30	100	53.3	69.7	80	43.7	57.2	65	36.6	47.9	50	29.2	38.2	40	24.1	31.5	30	18.6	24.3
11	33	110	58.4	76.4	88	47.1	62.7	71½	40.1	52.4	55	32.1	41.1	44	26.3	34.4	33	20.3	26.6
12	36	120	63.3	82.8	96	52.1	68.2	78	43.6	56.1	60	34.8	45.6	48	28.6	37.4	36	22.2	28.9
13	39	130	68.2	89.2	104	55.7	73.0	84½	46.1	61.5	65	37.4	48.1	52	30.9	40.4	39	23.9	31.2
14	42	140	73.6	96.2	112	60.2	78.7	91	50.7	66.3	70	40.3	52.7	56	33.2	43.4	42	25.7	33.6
15	45	150	78.3	102.4	120	64.2	83.9	97½	53.1	70.6	75	43.0	56.3	60	35.4	46.2	45	27.4	35.9
16	48	160	83.2	108.8	128	68.3	89.3	104	57.3	74.1	80	45.8	59.9	64	37.5	49.0	48	29.1	37.1
17	51	170	88.4	115.7	136	72.3	94.6	110½	60.9	79.6	85	48.6	63.5	68	39.8	52.1	51	30.9	40.4
18	54	180	93.1	121.7	144	76.4	99.9	117	64.1	83.8	90	51.4	67.2	72	42.1	55.1	54	32.5	42.5
19	57	190	97.9	128.0	152	80.1	104.8	123½	67.3	87.1	95	53.1	70.6	76	44.3	58.1	57	34.1	44.6
20	60	200	103.0	134.7	160	84.7	110.8	130	70.1	92.8	100	56.7	74.1	80	46.6	60.9	60	35.9	46.9
21	63	210	107.4	140.4	168	88.0	119.1	136½	74.3	97.2	105	59.2	77.4	84	48.9	63.9	63	37.7	49.3
22	66	220	112.7	147.4	176	92.4	120.8	143	77.9	101.8	110	61.9	80.9	88	51.2	66.9	66	39.5	51.6
23	69	230	117.7	153.9	184	96.7	126.4	149½	81.4	106.4	115	64.9	84.8	92	53.4	69.9	69	41.2	53.7
24	72	240	122.3	159.9	192	100.2	131.1	156	84.5	110.5	120	67.3	87.1	96	55.2	72.2	72	43.0	55.2
25	75	250	127.5	166.7	200	104.5	136.6	162½	87.9	114.9	125	69.9	91.5	100	57.7	75.4	75	44.8	58.6
26	78	260	131.1	172.6	208	108.7	142.2	169	91.7	119.9	130	72.8	95.2	104	59.1	78.5	78	46.5	60.8
27	81	270	136.8	178.9	216	112.1	146.5	175½	94.4	123.5	135	75.5	98.8	108	61.8	80.8	81	48.1	62.9
28	84	280	141.2	184.7	224	116.4	152.2	182	97.5	127.5	140	78.0	102.0	112	64.0	83.7	84	49.5	64.7
29	87	290	146.3	191.3	232	119.2	156.7	188½	100.6	131.6	145	80.7	105.6	116	66.3	86.7	87	51.3	67.1
30	90	300	150.7	197.0	240	123.5	161.5	195	103.8	135.9	150	83.2	108.8	120	68.4	89.5	90	52.8	69.0
31	93	310	155.5	203.4	248	127.9	167.2	201½	107.1	139.1	155	87.1	113.9	124	70.6	97.3	93	54.5	71.3
32	96	320	160.6	209.1	256	131.8	172.4	208	111.2	145.4	160	88.7	116.0	128	72.1	99.6	96	56.2	73.5
33	99	330	164.6	215.3	264	135.2	176.8	214½	114.1	149.2	165	91.0	119.0	132	74.8	97.8	99	57.9	75.7
34	102	340	169.0	221.0	272	139.3	182.0	221	117.0	153.0	170	93.6	122.4	136	77.1	100.8	102	59.6	77.9
35	105	350	173.6	226.1	280	142.9	186.6	227½	120.3	157.3	175	95.7	125.1	140	78.8	103.0	105	61.2	80.1
36	108	360	178.8	233.8	288	146.8	192.0	234	124.2	162.8	180	98.3	128.5	144	81.1	105.1	108	63.1	82.5
37	111	370	183.1	240.6	296	150.8	197.2	240½	127.1	166.2	185	101.4	132.6	148	82.9	108.4	111	64.5	84.4
38	114	380	187.9	245.7	304	154.0	201.9	247	129.4	169.2	190	103.5	135.3	152	84.1	111.1	114	65.7	85.9
39	117	390	192.4	251.6	312	158.5	207.2	253½	133.1	174.4	195	106.3	138.1	156	87.1	113.9	117	67.6	88.4
40	120	400	196.6	257.1	320	161.3	210.1	260	135.1	177.8	200	109.2	142.8	160	89.4	116.9	120	69.2	90.5

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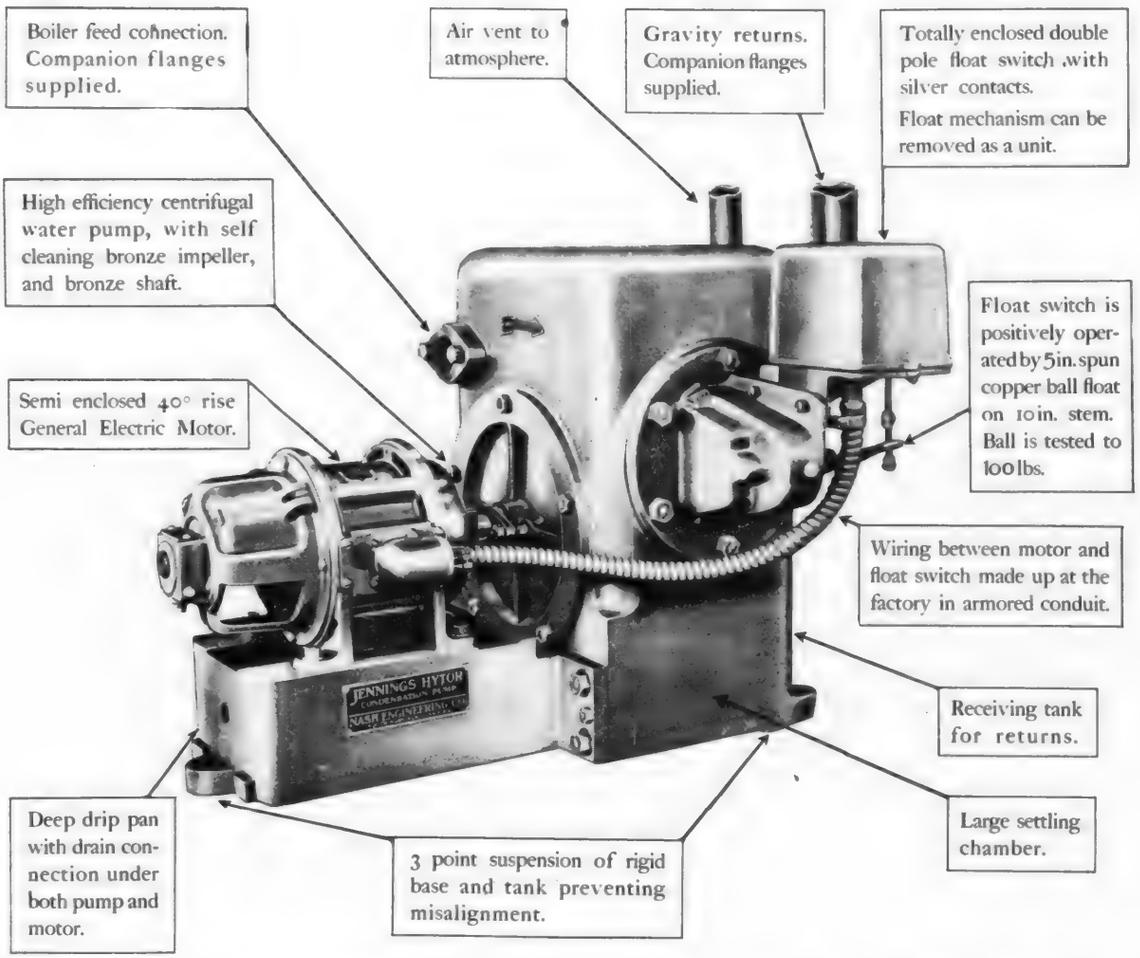
RADIATOR RATINGS—4-COL. STEAM, ENCLOSED, TWO-TOP REGISTERS | No. 14-O

Copies of this Data Sheet, printed separately, 5 cents each.

THE NEW UNIT TYPE JENNINGS HYTOR CONDENSATION PUMPS


Boiler feed connection. Companion flanges supplied.
Air vent to atmosphere.
Gravity returns. Companion flanges supplied.
Totally enclosed double pole float switch with silver contacts.
Float mechanism can be removed as a unit.
High efficiency centrifugal water pump, with self cleaning bronze impeller, and bronze shaft.
Semi enclosed 40° rise General Electric Motor.
Float switch is positively operated by 5in. spun copper ball float on 10in. stem. Ball is tested to 100lbs.
Wiring between motor and float switch made up at the factory in armored conduit.
Receiving tank for returns.
Large settling chamber.
Deep drip pan with drain connection under both pump and motor.
3 point suspension of rigid base and tank preventing misalignment.
JENNINGS HYTOR
CONDENSATION PUMP
NASH ENGINEERING CO.

The illustration shows construction of the Jennings Condensation Pump Unit. By making the pump casing a part of the receiving tank and bolting to the tank the base supporting the motor, allowing the motor bearings to support the bronze impeller, great structural strength is secured. The three point support prevents the pump from being sprung ont of line.

Large motor bearings supplied with ample oil wells support the pump impeller and keep it in alignment. Only occasional lubrication is necessary. The impeller is open type, self-cleaning, and very efficient.

The float switch mechanism is liberally proportioned, equipped with bronze shaft supported by two bearings.

The special G. E. double-pole float switch is totally enclosed and provided with silver contacts for long life. Switch mechanism can be removed as a unit.

The finest materials and best workmanship used in construction throughout, and all parts are machined to such close limits that absolute interchangeability is secured.

For Detailed Description Ask for Bulletin No. 29

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Trade and Miscellaneous Notes

Pricing Quantities on a Unit Hour Basis

The Associated Building Contractors of Illinois, under the leadership of Gerhardt P. Meyne, Chicago, Ill., has worked out a plan for pricing quantities on a unit hour basis for use by its members.

Steps taken in working out this valuable program for the contractors, may be summarized in a general way under four headings; first, placing before the builders a standard estimate sheet; second, adopting a standard method of taking-off quantities in the various branches of the trade; third, a standard of field over-head; and fourth, standard method of cost-keeping to develop a method of pricing quantities.

While the committee did not feel that it should arbitrarily direct or even recommend the adoption of a particular standard sheet, it was felt that the forms worked out would prove suggestive to every member of the industry.

Novel Plan to Boost Convention Attendance

A convention club has been formed by the Pittsburgh Water Heater Co., Pittsburgh, Pa., designed to make it possible for 100 master plumbers to attend the convention of the National Association of Master Plumbers at West Baden Springs, through increased sales effort. The plan is to have dealers furnish a list of "prospects" which will then be circularized and visited by representatives of the Pittsburgh company. Each sale made as a result of this special effort will be credited on a convention fund for the dealer who originated the prospect.

Coming Events

May 12-16, 1924—Annual meeting of the National Association of Public School Business Officials, in Indianapolis, Ind. Headquarters at the Claypool Hotel.

May 21-23.—Fifteenth annual convention of the National Pipe and Supplies Association, in Cleveland, O. Headquarters will be at the Hotel Cleveland.

May 26-29, 1924.—Annual convention of the Heating and Piping Contractor's National Association, in Atlantic City, N. J. Headquarters will be at the Chalfonte-Haddon Hall.

June 10-12, 1924.—Midsummer meeting of the American Society of Heating and Ventilating Engineers, in Kansas City, Mo. Headquarters at the Hotel Muelebach.

June 10-12, 1924.—Annual convention of the National District Heating Association, in New York City. Headquarters at the Hotel Commodore.

June 24-26, 1924.—Forty-second annual convention of the National Association of Master Plumbers, in West Baden, Ind. Headquarters at the West Baden Springs Hotel.

Miscellaneous Notes

American Construction Council, which is devoting much effort to a solution of the apprenticeship problem in the building industry, held its semi-annual meeting at the home of its president, Franklin D. Roosevelt, 49 East 65th Street, New York, April 22. One of the interesting papers read was the report of D. Knickerbacker Boyd, executive vice president, describing the results of his recent trip to the Pacific coast, including the organization of two new construction councils, one in Denver and one in Minneapolis.

National Association of Sheet Metal Contractors will hold its annual convention in Washington, D. C., June 17-20, 1924. Headquarters will be at the Raleigh Hotel.

INSTALL AUTOVENT FANS ON YOUR INDUSTRIAL JOBS

REFLECTED in the efficient performance of Autovent Fans is years of close contact with all industrial conditions on the part of Autovent engineers. This has enabled them to intelligently design equipment to meet all needs.

Industrial air conditions are varied and the fans used must be adapted to the particular job assigned them.

When working on your next industrial job refer to our Tenth Edition Catalog in your files, for specifications and performance tables.

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Salvation Army plans for the Home Service Appeal to obtain a maintenance fund of $512,000 for its work in Greater New York are rapidly maturing. Clyde R. Place has accepted chairmanship of the engineering group and will be assisted by Edwin E. Seelye, Frank A. Pattison, and A. E. Hanson. The campaign will be before the public May 4 to 17, 1924.

Heating and Piping Contractor's Memphis Association, Memphis, Tenn., elected the following officers at its meeting, April 4: President, W. J. Hughes; vice-president, Frank Donlon; secretary, Harry Smith; treasurer, John Fischer.

Joint Safety Conference, under the auspices of the engineering section of the National Safety Council, the Cleveland Engineering Society and the Society of Ohio Engineers, will be held in Cleveland, O., May 16, at the Winton Hotel. Sessions will be held morning and afternoon. One of the papers will be devoted to the development of Ohio's workmen's compensation law and codes. Another paper by F. C. Allen, of Allen and Billmyre, Billmyre Co., Inc., New York, will discuss "Dust Collection."

Russell T. Gray, advertising engineer, Chicago, Ill., announces the removal of his offices to the Peoples Life Building, Randolph and Wells Streets, where he will occupy the sixteenth floor, providing greatly increased quarters and facilities.

Tenth Exposition of Chemical Industries, to be held at the Grand Central Palace, New York City, Sept. 28-Oct. 3, 1925 announces that all exhibit space on the main floor already has been contracted for by chemical and chemical equipment companies.

Building Construction for the country as a whole increased 44% in March as compared with the previous month, but the statistics disclosed a wide contrast between the activity in New York and other parts of the United States. New York City's March total was $131,611,100, eclipsing all previous records, an increase of 83% over February and 130% over March of last year. Construction contracts awarded for the country as a whole aggregated $433,340,300. Total construction started during the first quarter of 1924

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WHETHER a man is an office employe or factory worker his day's work is measured by the atmospheric conditions of the room in which he toils. And there's nothing so important in promoting human welfare, efficiency, safety and contentment as fresh, invigorating air—it's the life force of man power.
Any work shop, office, store, etc., can be correctly ventilated with an ILG Fan for a few cents a day. And the ILG is the only ventilating fan with a fully enclosed self-cooled motor—made, tested, sold and guaranteed as a complete unit —it's painted green.
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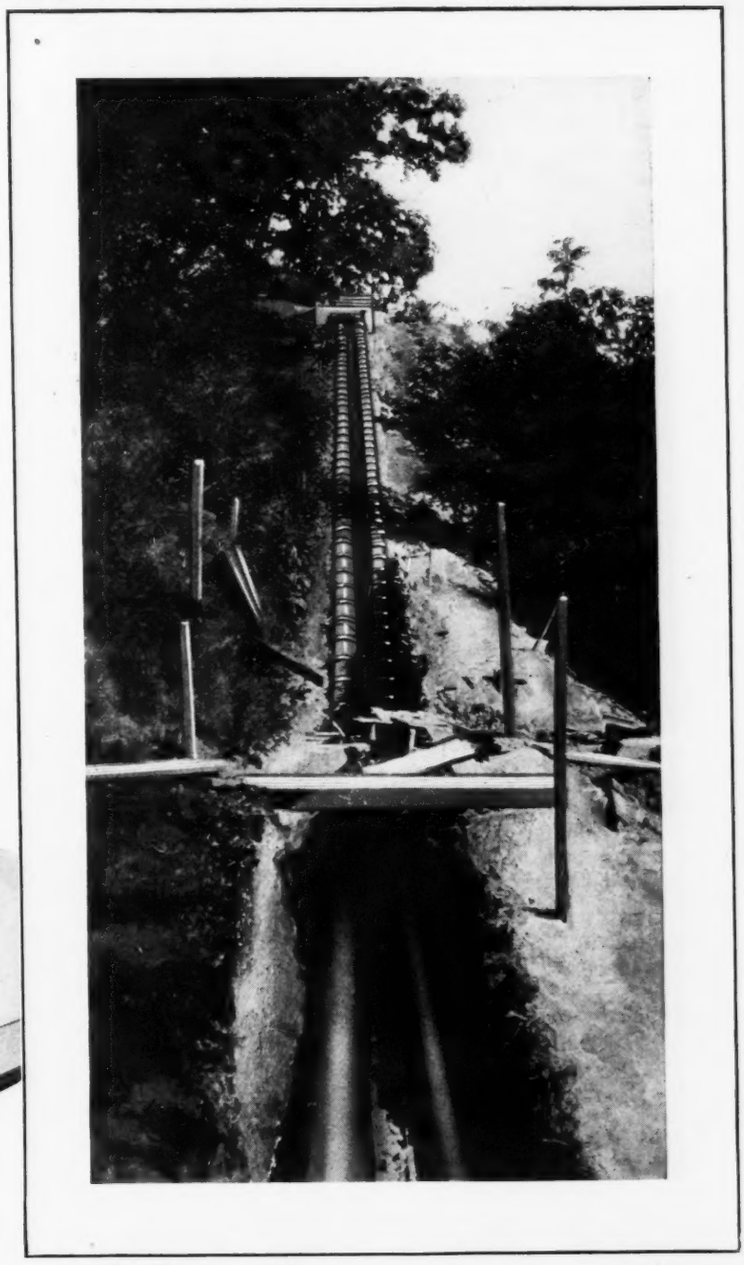

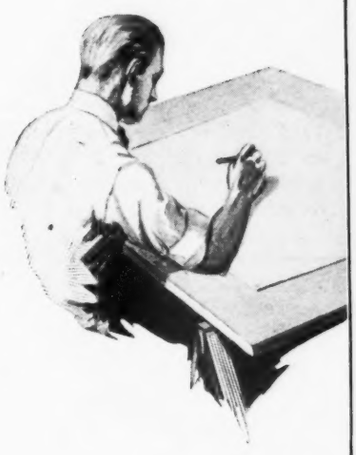

A responsibility that starts with the planning —and never ends

IF users of the Johns-Manville Underground System of Insulation only thought of it as so many feet of piping insulated by a certain method, there wouldn't be nearly as many miles of the System in service as there are to-day.

A Johns-Manville Installation is more than a sale of material, it is the promise of satisfactory service in the years to come. This promise is backed by the responsibility of a nationally known organization that has been successful in insulation work for over fifty years — and which expects to be in business for a long time in the future.

JOHNS-MANVILLE, Inc.
292 Madison Ave. at 41st St., N. Y.

Branches in 62 Large Cities
For Canada: Canadian Johns-Manville Co., Ltd., Toronto

Through Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
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FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE
Underground System of Insulation

amounted to $1,034,870,900, an increase of 15% over the corresponding period of 1923.

United States Civil Service Commission announces open competitive examinations for positions as engineer, $3,800 to $5,000 a year; associate engineer, $3,000 to $3,600 a year; and assistant engineer, $2,400 to $3,000 a year. Applications will be received until July 1. The examinations are to fill vacancies in the Bureau of Standards, Department of Commerce.

Arbitration Society of America held its second annual dinner at the Hotel Biltmore, New York City, on the evening of May 6. Representative leaders in business and professional life discussed the arbitration movement from the standpoint of personal experience. Two recent court decisions which upheld the policy of arbitration, have given new impetus to the movement.

Chamber of Commerce of the United States, at its annual convention in Cleveland, O., May 6-8, 1924, gave special attention to trade associations and their activities. A special group meeting of leading manufacturers, devoted to discussions of the problems of business and agriculture, European readjustment, and the responsibility and integrity of business, featured the opening day of the convention.

Central Heating Station Notes

Sheldon, Ia.—The Commercial Club of Sheldon has taken up the matter of a central heating system for the business district. It is planned to form a stock company, each business man to take a proportionate share of stock to be paid for in heat. The estimated cost of the plant is $70,000.

Denver, Colo.—A central heating plant to furnish heat for the Brown palace and the new Ritz-Carlton hotel is planned by the Bennett-Boettcher interests in Denver.

Tucson, Ariz.—Members of the Morgan McDermott post, American Legion, Tucson, Ariz., are agitating a movement to establish a central heating station for the MacArtan hospital, now being used as a veterans' hospital.

Manufacturers' Notes

Monarch Metal Products Co., St. Louis, Mo., manufacturers of the Monarch interlocking weather strip, announces the creation of a new department to known as the Department of Engineering Research. James S. Anderson will direct the new department, which will seek to acquaint the architectural and engineering profession with the latest research pertaining to the reduction of heating costs through window infiltration control.

Richmond Radiator Co., 1480 Broadway, New York City, has opened a branch office in Cleveland, O., under the management of J. H. Bacon, formerly sales manager of the Kennedy Co. Shipments will be made from the company's Uniontown, Pa., office until warehousing facilities are arranged at Cleveland.

Honeywell Heating Specialties Co., Wabash, Ind., which recently issued $100,000 preferred stock, has acquired additional factory facilities permitting it to double its output. The new factory is to be known as Plant No. 2 and will be used for the manufacture of the Honeywell line of temperature and pressure-controlling equipment, Plant No. 1 being devoted exclusively to the manufacture of motors. The company reports that since 1921 the Honeywell company's business has doubled each year and, according to statements of their officials, prospects for 1924 are favorable for an increase in volume of from 75% to 125%. This increase is attributed to the increasing demand for the automatic control of heating plants using coal, gas or oil as fuel.

Davidson & Co., Ltd., Central House, Kingsway, W. C. 2, London, England, announces that G. Gordon Huntley, A. M. I. E. E., M. I. H. V. E., has relinquished his connection with the consulting engineering practice of Messrs. Huntley & Wood, and joined the Davidson technical staff at London.

Kirk & Blum Mfg. Co., Cincinnati, O., announces that H. H. Valiquet, for 18 years chief engineer of the B. F. Sturtevant Co., has joined the organization as chief engineer. Mr. Valiquet will specialize in the designing of dust-collecting and pneumatic conveying sys-

PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
Over one Hundred Lehigh Fans are installed in New York City Schools
Engineers—New York Board of Education.
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FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior to, any other fans on the market.

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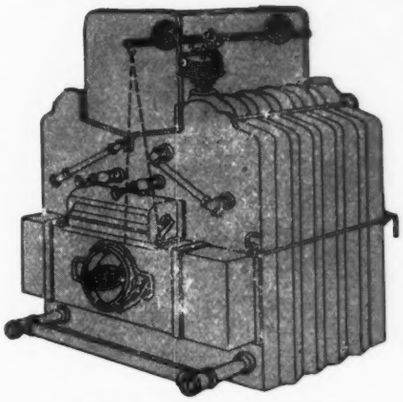
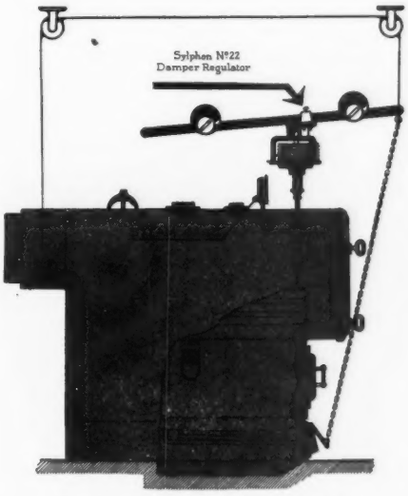
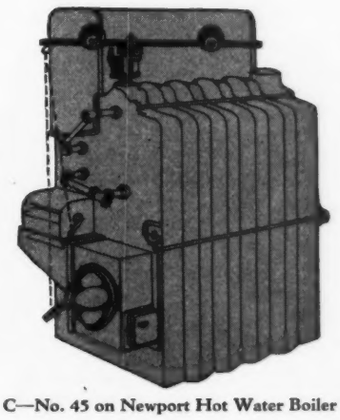


A—No. 22 on Newport Steam Boiler



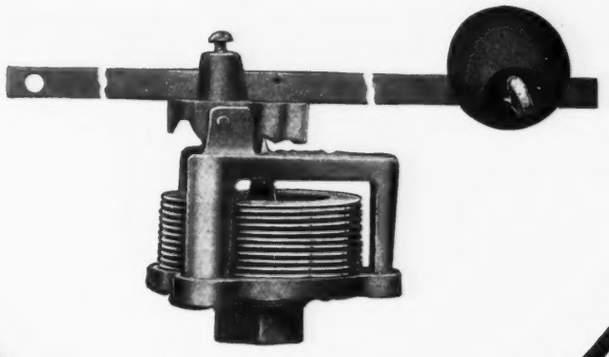
B—No. 22 on Birchfield Steam Boiler



C—No. 45 on Newport Hot Water Boiler

Over 1,000,000 Installations

Sylphon N°22
Damper Regulator



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Steam boilers

Standard Equipment on all these

Abco	Coil	Oil City
Ames	Floral City	Pebco
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Install anyone of these 18 leading boilers

When you install boilers that are Sylphon equipped (and you've 18 to choose from) you do two things—Get a boiler that is a recognized leader, and, once your installation is properly made, are safe from damper regulator troubles.

Every Sylphon Damper Regulator contains as its expansion member the Sylphon Bellows. Drawn from a flat sheet of metal, it is absolutely without soldered seam; powerful, flexible, it will last as long as the boiler, and always open and close the drafts smoothly and positively.

Get Bulletin WDR on Sylphon Damper Regulators

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Crosby Valve & Engineering Co., Ltd., 41-42 Foley Street, London, W. I., England

Canadian representatives:
Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

tems, drying, heating, ventilating, cooling and fume removal systems, and air conditioning systems.

Reliance Gauge Column Co., Cleveland, O., has recently appointed representatives in Pittsburgh and Cleveland. The company's Pittsburgh representatives are the S. I. Fink Co., at 227 Second Avenue, and the Chicago representative is the O. C. Keckley Co., 565 Washington Boulevard.

Richmond Radiator Co., New York, reports a net profit for the year ending December 31, 1923, of $354,770, as compared with a deficit of $117,517 for the preceding year.

Chicago Pump Co., Chicago, Ill., at the monthly dinner meeting of its sales and factory executives, April 10, was addressed by J. E. Dutcher, of the architectural firm of Schmidt, Garden & Martin, who presented some interesting side lights on the consulting engineer's duties and showed how the manufacturer could be of assistance to the engineer. The dinner meeting is a regular affair held by this company. At each one a prominent architect or engineer is invited to speak and views are exchanged on the various ways in which the customer can best be served.

York Heating and Ventilating Corporation, Philadelphia, Pa., has opened a New York office in the Singer Building, 149 Broadway, in Room 623, for the sale of the company's line of unit heaters, blower systems, dust exhaust and recovery systems, drying equipment, sheet metal construction, etc. The manager is H. Berkley Hedges, formerly secretary of the Philadelphia Chapter of the American Society of Heating and Ventilating Engineers.

International Heater Co., Utica, N. Y., has appointed A. D. Blackwell as its representative in Greater Cincinnati. Mr. Blackwell's offices are at 410 Bell Block Building, where he has represented the Utica Heater Company in Cincinnati for a number of years.

American District Steam Co., North Tonawanda, N. Y., has appointed Austin, Gorham & McIlvaine Co., Philadelphia, Pa., as its sales agents for eastern Pennsylvania, Delaware, and southern New Jersey.

New Firms

Fiedler Engineering Co., White Plains, N. Y., is the title of a new firm in the general heating engineering and contracting field. The general manager of the company is H. W. Fiedler, formerly assistant to the chief engineer of the American Radiator Company. Offices have been opened at 178-189 Martine Ave., White Plains.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

POSITION WANTED—Mechanical Engineer with extensive and varied experience in heating, ventilating and steam power plants (large and small units). Good executive. M. E. degree. Age 31. Employed. Prefer large city location. Address Box 51, care of Heating and Ventilating Magazine.

WANTED—Boiler Salesman. Man with ability to take charge of boiler department of large manufacturer, handle sales, etc. Address Box 52, care of Heating and Ventilating Magazine.

WANTED—Several good furnace and boiler salesmen. Men of experience and ability, good salary. Address Box 53, care of Heating and Ventilating Magazine.

SALESMAN WANTED—Manufacturer and jobber of heating and plumbing material in middle West has several territories in Chicago and vicinity open for high-class men. Thorough knowledge of heating and plumbing business absolutely essential. Connection is very desirable one, and only men of proven ability will be considered. Address Box 54, care of Heating and Ventilating Magazine.

EXECUTIVE WANTED—Manufacturer and jobber of heating material has opening at head of heating department, Chicago branch. Man must have sales and executive ability and thorough engineering knowledge of low-pressure heating installations. One familiar with conditions in this field in Central West preferred. Address Box 55, care of Heating and Ventilating Magazine.

FOSTER BACK PRESSURE **VALVE**

All working parts inside of the body. Noiseless in operation.

Easily thrown out of commission when desired.

High grade in every particular.

Service is Guaranteed.

FOSTER ENGINEERING CO., NEWARK, N. J.

AIR CONDITIONING TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC CONDITIONING CORPORATION
LAFAYETTE BLDG.
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Fans—Air Filters Equipment

Ilg, window or wall-type ventilating fans, 440-volts, 3-phase, 60-cycle. Motors will be changed to 220 volts for a nominal charge, if desired.

Fan Dia. In.	Motor	Speed
24	¼ H.P.	850 R.P.M.
30	⅜ H.P.	690 R.P.M.
36	¾ H.P.	565 R.P.M.
48	1½ H.P.	490 R.P.M.
72	2¼ H.P.	285 R.P.M.

One complete Midwest air filter, ready to connect to air lines. Capacity 26,000 C.F.M. Slightly used.

Buffalo Type B air washer for dust removal, capacity 5,000 C.F.M. Used.

American Blower engine, Type A, 8x11 in., 100 lbs. pressure, 400 R.P.M. New.

Moore steam turbine, type R-3-R, medium pressure, 28 H.P., 2310 R.P.M. with 5 to 1 reduction gear. New.

The above represent a few items surplus with us due to changes in plant layouts.

Prepare now for your warm weather needs!

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